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THE JOURNAL OF THE BOTANICAL SOCIETY OF SOUTH AFRICA

Edited by H. H. W. PEARSON,
M.A., Sc.D., F.L.S., Hon. Director,
NATIONAL BOTANIC GARDENS
:: :: :: KIRSTENBOSCH :: :: ::

Part I. 1915

Published under the authority of the Council of the Botanical Society

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The Journal of the Botanical Society of South Africa

PART I. 1915

Edited by H. H. W. PEARSON, M.A., SC.D., F.L.S., Hon. Director, National Botanic Gardens, Kirstenbosch

FOREWORD

THE Journal of the Botanical Society of South Africa first sees the light under conditions which are not propitious for enterprises such as that with which the Society is identified. During a world struggle in which no less than civilisation itself is at stake, the works of civilisation cannot but be retarded.

The Botanical Society has exercised a most important influence upon the development of the National Botanic Gardens from the moment of their establishment; the importance of that influence becomes even greater in the circumstances of the time.

The prime objects of the Journal are to form a link uniting the scattered membership of the Society in a common purpose; to bring the Society into closer touch with Kirstenbosch, for whose advancement to the state of a National Garden it has constituted itself; to aid in stimulating the already widespread interest in the preservation, cultivation, and study of the vegetation of South Africa.

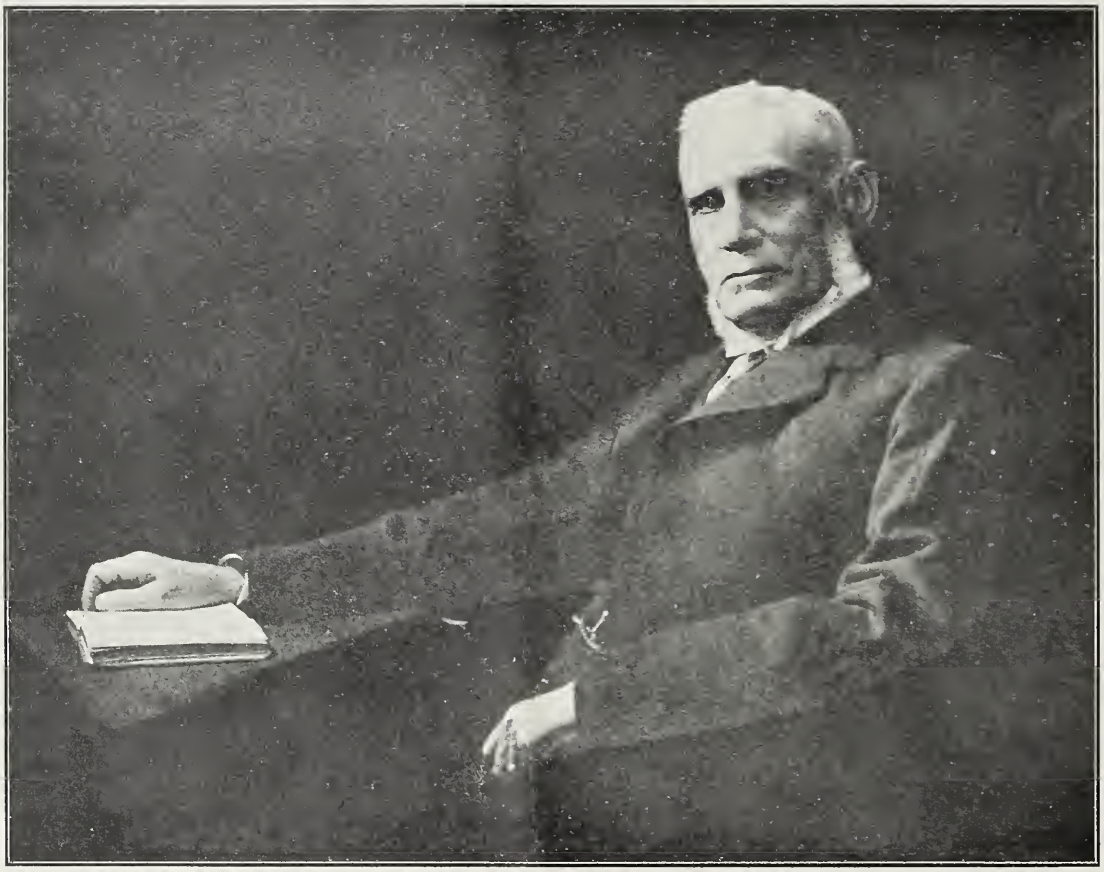
The exact form which future issues of the Journal will take and the methods adopted to achieve its purposes must depend upon its opportunities, and these upon the measure of generosity with which it is received.

H. H. W. P.

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THE FIRST PRESIDENT OF THE BOTANICAL SOCIETY



THE RIGHT HON. SIR J. H. DE VILLIERS, K.C.M.G., LL.D.,
FIRST BARON DE VILLIERS OF WYNBERG, 1842—1914

LORD DE VILLIERS

IT is fitting that the first number of the Journal of the Botanical Society should be associated with the memory of its first president, the first Baron de Villiers.

Lord de Villiers was keenly interested in all measures tending to the due preservation of the natural and historic features of the country of his birth, which he loved so well and served so faithfully. The objects of the Botanical Society therefore made a strong appeal to him. How great a part he played in the movement which led to the formation of the Society and the establishment of the Gardens is well known. The prestige of his name and his great personal influence gave to it an impetus which otherwise might have been lacking, and there is little doubt that his support was one of the principal factors which determined the issue.

In his dual capacity of President of the Botanical Society and Chairman of the Trustees of the Gardens, he took the deepest interest in the welfare of both, and to advance it was always ready to sacrifice his leisure and convenience. Far from regarding the office of trustee as a sinecure, he took an active part in the early stages of the work at Kirstenbosch. During the first year of operations, no step of importance was taken without his knowledge, and his advice and encouragement were of the utmost value to those immediately responsible for transforming a wilderness into a garden. If, as we believe, the National Botanic Gardens have had a good beginning, they owe it in a large measure to the first Chairman of Trustees.

In the death of Lord de Villiers thus early in their history, both the Gardens and the Society have suffered a grievous loss. Robbed of his invaluable help, we owe it to his memory to proceed with increased determination towards the full achievement of the end he had in view.

H. H. W. P.

THE BOTANICAL SOCIETY AND THE NATIONAL BOTANIC GARDENS

THE establishment of the National Botanic Gardens in 1913 was the beginning of the realisation of an idea which found expression at the Cape as early as the middle of the eighteenth century. The foundation of the Gardens and of the Society is therefore a matter of some historic interest. The circumstances which immediately led to it are fresh in the minds of those who will read these lines. But the time will come when a brief record of the facts will serve a useful purpose. The term "Botanic Garden" is not very easily defined. It might be claimed that every true garden is a botanic garden. In practice, however, the term is applied to gardens, not necessarily public gardens, which definitely include among the objects of their existence the advancement of the science of Botany (*i.e.*, the knowledge of plants) as a whole, or of some specified part of it. Botanic gardens may therefore differ very considerably in their purposes, in their equipment and in their achievements. The Botanic Gardens which have appeared or still exist in South Africa have, in the main, represented two more or less distinct types.

ACCLIMATISATION GARDENS

The first of these, appropriately termed an "Acclimatisation" Garden, is commonly associated with the early settlement of a new country. One of the first needs of a colonist in a newly occupied territory is for plants of proved economic value, which either will yield the means of support or are likely to afford any desired amelioration of the conditions under which he has to live. He not only wants the plants, but, in addition, he desires to know what are the prospects of their success and the conditions which will determine it. These wants are satisfied by the Acclimatisation Garden, in which can be seen economic and other plants from other countries which are judged to be suitable for cultivation in the new country. Here their power of adapting themselves to the new conditions is tested, and the garden becomes a centre from which they are distributed to those who need them. The greater the difference between the conditions of the new country and those of the home from which the colonist has come, the greater is the need for such an Acclimatisation Garden. Consequently we find this type of garden in nearly all tropical colonies.

Such gardens have in the past done very valuable service in South Africa ; in fact nearly all the South African public gardens have at one time or another in their history made a special feature of the acclimatisation of desirable exotic plants.

The earliest of the Cape Acclimatisation Gardens was the old " Company's Garden " which has given a name to a residential district of Cape Town, and parts of which are preserved in the grounds of Government House and in the Municipal Gardens. It was occupied mainly by economic plants brought from Europe or the East ; their produce supplied the official tables and the surplus stock was at the service of passing ships. For nearly thirty years (1747-1772) this garden was under the superintendence of the well-known botanical collector, J. A. Auge, who enriched it by many " rare and curious African species," which he collected during numerous journeys into the interior. In this way, to quote MacOwan, " Auge used his utmost diligence to raise the Company's Tuin above its original cabbage growing into something like a Botanic Garden." Although Auge's specimens throve among the cabbages, and some indeed are still to be seen in the present Municipal Gardens, the Company's horticultural effort was primarily, for considerable periods entirely, directed to the cultivation of useful exotics. The distinguished botanist, Thunberg, who first saw the Cape in 1772, tells us that among the Cape gardens of the time " that extensive and beautiful garden belonging to the Company distinguishes itself like an oak amidst a thicket of bushes " ; and while he pays a well-merited, if somewhat qualified, compliment to Auge, he does not mention the native plants which were then growing in the garden under his charge.

There appears to be little information as to the character of the Botanic Garden which Liesching and de Ziegler commenced to make in the vicinity of " Botany Bay," Sea Point, and for which the land was granted to them in 1806. But as Liesching was a medical man, and as their intention was officially described as " beneficial," the cultivation of drug-yielding plants was perhaps an important part of their scheme. Of their success there is no record.

The work of acclimatisation was also carried on in certain private gardens. In his account of " The State of the Cape of Good Hope in 1822," Col. Bird writes of Mr. M. van Breda, who owned and occupied the Oranjezicht estate : " He is the most experimental horticulturist of the Cape. His gardens supplied the naval establishment with vegetables, but they are now vineyards, except a part reserved for the curious and useful plants of the East and other countries." Mr. van Breda, like all good gardeners, " distributes with generosity the rare plants which he collects, and is courteous to the visitors of his gardens. Desirous of profiting by the improvements of others, he enquires into the practice of all nations and politely imparts all the information within his knowledge." The editor of Bird's work (Mr. H. T. Colebrook) adds " a few annotations on topics of interest, upon which I am desirous of delivering my own sentiments at greater length." In these annotations he devotes several paragraphs to the Botanic Garden question. The olive, the cork-oak, the tea plant, and the date are valuable plants which should be experimentally cultivated, and for this purpose " a botanical and horticultural establishment at the Cape of Good Hope would be of the utmost utility, if instituted for practical no less than for scientific purposes ; to advance the science of botany and the art of horticulture and at the same time to serve as a nursery for the introduction and propagation of exotics and useful plants in South Africa." The garden is to be Government-aided for " such undertakings are beyond the reach of individual enterprise. . . ." The whole expense " would be repaid ten thousand fold by the public benefits which would flow from the institution."

The first of the more modern public Botanic Gardens was founded on a site included within the Company's garden, twenty-five years after the publication of Bird's memoir. Like those of the earlier period it was primarily an acclimatisation garden. Its first and main function was " to introduce from all parts of the globe useful, ornamental and fruit-bearing trees and shrubs, plants, flowers and vegetables, and to promote their distribution and culture throughout Southern Africa." Other public gardens of contemporary or later origin were more or less definitely designed to do similar work for the districts in which they were created.

As the settlement of a new country advances, its public services become more highly organised and much of this work of acclimatisation is taken over by Government Departments of Agriculture, Horticulture, and Forestry, or becomes the object of private industrial enterprise. But the Government Department, like the professional nurseryman, is fully occupied as a rule with plants of ascertained economic value and has little opportunity of indulging in speculative experiment. Plants whose commercial value is not established or even suspected, though in many cases none the less real, are still left for the Botanic Garden—or left alone. Consequently, although the importance of the Botanic Garden for purposes of economic acclimatisation is diminished, it will never cease until our knowledge of the economic plants of the world is complete.

BOTANIC GARDENS

But the causes which bring about a lessening of the activities of the Botanic Garden in the acclimatisation of economic plants provide it with the opportunity for a higher form of usefulness. The increase in settled population and its higher degree of organisation involve a raising of the standard of culture, an increase in the facilities for a generous education, and eventually the provision of the means for taking part in the extension of the boundaries of knowledge. One of the first results of this quickening of the spirit is the desire to know more of the new country and to compare it with other parts of the world. Thus the new nation acknowledges the duty imposed upon it by civilisation—a duty which it owes to itself and to the rest of the world. This obligation sooner or later finds expression in the foundation of Libraries and Museums and in collections of materials and equipment for the study of natural phenomena.

This phase of national development was reached long ago at the Cape. It did not immediately produce a Botanic Garden adapted to the new aspirations, but it did produce a demand for one. The *Cape Monthly Magazine*, published in 1857, contains an extremely interesting article entitled " A Cape Botanical Garden as it should be," by a well-informed writer, who unfortunately conceals his identity under the pseudonym " Hortulanus." " Hortulanus " finds no satisfaction in the Cape Town Garden (the present Municipal Garden), whose management calls for—and receives—marks of his disapproval. He demands an establishment of a much more generous character. Its area is to be about five hundred acres. It is still to be engaged in acclimatisation work, but it has much else to do as well. It is to include a " garden of indigenous South African plants," in which " many species might be preserved to futurity that are at present fast disappearing from their native wilds."

It must be provided with a herbarium and a botanical museum—and if " Hortulanus " had written a few years later we may be sure that he would have added research laboratories to the list. It is to furnish information on botanical matters to the public—of which botanical information "the present commissioners of the Cape Town Garden are remarkably chary—inexcusably so indeed." The superintendent must be " up to the mark " and " capable of introducing what is wanting here, viz., a system of horticulture suitable to the climate." He must be in correspondence with botanic gardens and botanists in other parts of the world, and send them Cape plants in exchange for species from other countries. These and other conditions laid down by " Hortulanus " prove that he had a very clear idea of the kind of Botanic Garden that was needed here—viz., a Colonial Kew. But that he lived too soon was apparently realised by the editors of the magazine, who, in an ecstasy of pessimism, write : " We give this paper because it is the production of one who understands his subject, and not because we anticipate that the suggestions it contains will ever be carried out at this end of the Colony."

PLEASURE GARDENS

The Botanic Gardens already established made a more or less conscious effort to adapt themselves to the changing conditions. In the view of " Hortulanus " and other competent judges, that of Cape Town did not attain any great measure of success—as is emphasised in the evidence given before a Cape Parliamentary Committee in 1877. And there is sufficient evidence that what was true for Cape Town was equally true also for all the other public gardens of the country. In so far as they failed their failure was due to inherent causes- they were handicapped by their position, their size, their equipment and their resources. These being inadequate, the old acclimatisation gardens became, each in its own way, what MacOwan called " a town pleasaunce of flowers and shady walks," and thus more than justified its continued existence. Not one advanced to the status of a true Botanic Garden. The need for the Botanic Garden was felt, but the determination to give it the organisation and the funds necessary for its support and development had not yet been reached.

PRIVATE BOTANIC GARDENS

Some of the work of the real Botanic Garden was, however, being done by private enterprise. A conspicuous example of this is still to be seen in the garden of the late Mr. H. M. Arderne, which contains probably the most interesting general botanical collection in South Africa.*

Collections of succulents and other peculiar forms which abound in South Africa have been maintained for many years by Dr. Marloth, Mr. Pillans, and others.

* The earnest hope may be expressed that means will be found for the preservation intact of this well-known garden. It contains a rich collection of exotic and South African trees and shrubs, which could not be replaced in half a century. Its destruction would remove the most interesting record which the Cape possesses of the private horticultural enterprise of two generations of skilled enthusiasts.

Such gardens helped to keep alive the desire to see in existence at the Cape a public Botanic Garden which should do justice to the wonderful vegetation of the country and to the magnificent scope for botanical study and horticultural effort which it affords. But it was not until the Union of the four Colonies had been effected that the establishment of a Botanic Garden on a proper footing came within the range of practical politics.

The subject was discussed at a meeting of the South African Association for the Advancement of Science, held in Cape Town in November, 1910. The project was generally supported by the South African press and by Botanical and Horticultural journals in other parts of the Empire, and by the South African Royal Society and National Society. At the annual meeting of the National Society held in Cape Town on February 4th, 1911, under the presidency of the late Lord de Villiers, a deputation was appointed to interview the Minister "on the question of the establishment of National Botanical Gardens and National Zoological Gardens." The matter was sympathetically mentioned by Mr. Long in the House of Assembly on April 6th, 1911.

BOTANICAL SOCIETY AND NATIONAL BOTANIC GARDENS

On March 9th, 1912, a public meeting, called "for the purpose of taking steps to establish a National Botanic Garden in the Cape Peninsula" was held in the Colonial Orphan Chamber. Lord de Villiers and, later, the Rt. Hon. J. X. Merriman, presided. In the course of his remarks, Mr. Merriman suggested the formation of a "National Botanical Society," and the following resolution was unanimously passed—"that a Committee be formed to consider the formation of a National Botanical Society, and to prepare details of a scheme for the establishment of a National Botanic Garden within the Cape Peninsula." While this Committee was still at work, the National Society, on October 12th, 1912, intimated "its willingness to co-operate with the Botanic Garden Committee."

Early in 1913 Sir Lionel Phillips gave his invaluable support to the movement and brought it to its penultimate stage on May 6th, when he moved the following resolution in the House of Assembly: "That in the opinion of this House, the Government should consider the advisability of setting aside a piece of ground at Kirstenbosch for the establishment of a National Botanic Garden." This motion, supported by many prominent members of the House, was carried unanimously. In less than a month from this date the assent and assistance of the Government were assured.

Several of those interested had suggested that the Gardens would be most suitably controlled by the proposed Teaching University. But, pending the establishment of the latter, and without prejudice to the future status of the Gardens, the Government decided that the estate and the full control of its development should be vested in a body of five trustees, of whom three would be nominated by the Government, one by the Corporation of Cape Town—from whom it was hoped

that financial assistance would be forthcoming*—and one by the Botanical Society of South Africa, whose formation was under consideration.

The Government appointed as Trustees, Lord de Villiers, the Hon. Sir David de Villiers Graaff, and Sir Lionel Phillips ; the Kirstenbosch estate was handed over to them on July 1st, 1913.

The Botanical Society came into existence on June 10th, 1913, and held its first meeting, under the chairmanship of its president, Lord de Villiers, on July 31st. The executive committee of the Society first met on August 14th ; its first business was the election of Mr. W. Duncan Baxter as the representative of the Botanical Society on the Board of Trustees. In the following October, the Corporation of Cape Town appointed the Mayor to represent it on the Board of Trustees, whose constitution was thus completed.

At their first meeting held on June 16th, 1913, the trustees appointed Dr. H. H. W. Pearson, Professor of Botany in the South African College, to the position of Hon. Director of the Gardens. Dr. Pearson had previously studied in the Royal Botanic Gardens, Ceylon, and had gained experience in Botanic Garden administration during four years' service on the staff of the Royal Gardens, Kew, under Sir W. T. Thiselton-Dyer.

The following appointments to the staff have since been made :—Secretary, Miss H. J. Davison, B.A. ; Curator, Mr. J. W. Mathews,† F.R.H.S. ; Gardener, Mr. H. W. Maynard† ; Ranger, Mr. J. Rohland.

Thus the National Botanic Gardens and the Botanical Society of South Africa came into existence. The two institutions were closely connected in their origin, and each will greatly influence the future development of the other. The Botanical Society in its constitution proclaims that the main purpose of its existence is to forward the interests of Kirstenbosch. The existence of the National Botanic Gardens is the result of more than a century of effort. Much is expected of them, both in this country and abroad. In the course of an address on " The History and Functions of Botanic Gardens," delivered on October 15th, 1914, on the occasion of the 25th anniversary celebration of the Missouri (U.S.A.) Botanical Garden, Mr. A. W. Hill, Assistant-Director of the Royal Botanic Gardens, Kew, referred to " the foundation only last year (1913) of the National Botanic Garden of South Africa, at Kirstenbosch, which, though the most recent of such gardens, bids fair to take a place in the front rank of the botanic gardens of the world, both on account of the admirable nature of the site and the remarkable character of the South African Flora."

Such expectations will be realised if adequate financial resources and the exercise of some degree of skill are assured. In normal times there would be little cause to fear that reasonable opportunity for generous growth and development would be lacking. In these critical days when constructive works, having no direct bearing upon what everyone must regard as our main immediate purpose, are necessarily forced into a position of comparative obscurity, the responsibility of the Botanical Society for the future of the National Botanic Gardens is far greater than could have been generally realised when the Society was founded.

* A hope which has been realised. † Trained at Kew.

THE ANNUAL REPORT OF THE BOTANICAL SOCIETY FOR THE YEAR 1914

THE full text of the annual report was presented at the annual meeting of the Society on March 30th, 1915. The following extracts therefrom are printed for permanent record and that they may be brought more prominently to the notice of members.

From the accounts laid before members it will be observed that a sum of £217 has been available during the year from current revenue for the Trustees of the National Botanic Gardens.

A further grant from the Life Members' Fund of £100, in addition to the £250 granted for the same object in 1913-1914, has been made during the current year towards the making of the Fernery at Kirstenbosch. The Executive feels sure that the members will endorse its action in voting this money towards a permanent improvement at Kirstenbosch with which the name of the Society will always be associated, and which, when completed, will form one of the most beautiful features of the Gardens.

A series of lectures on the Botanic Gardens of the world was inaugurated by the Society in June, when Professor Pearson delivered a lecture to the Society in the Banqueting Hall of the City Hall on "Kew." The lecture was delivered to a large audience and was in every way a great success. Arrangements had been made for a further lecture to be delivered by Dr. Goddard on "The Botanic Gardens of Sydney" in September, but on the outbreak of war the Executive deemed it advisable to postpone the lecture, which it is expected will be given in the course of the present year.

The Council was "At Home" to the members of the Society at Kirstenbosch on January 30th, 1915, when a large number of members and their friends were enabled to witness the progress that had been made during the year in the development of the National Botanic Gardens. The Hon. Director, Dr. Pearson, in the course of the afternoon, delivered a short address explaining the work.

At the date of the issue of the report the Society consisted of 33 life members ; 22 family members ; 264 ordinary members ; 33 associate members ; total 352.

It will be seen from this record that the membership of the Society has not increased to the extent that was anticipated. The Executive desires to emphasise the fact that the progress and development of the National Botanic Gardens are intimately connected with the maintenance and increase in membership of the Botanical Society. The greater part of the income of the National Botanic Gardens, derived from the Government and the Municipality and from the sale of estate produce, is consumed in maintaining the nursery, in keeping in order those parts of the estate which were cleared and planted during the first year and a half of its occupation, and in the protection of the estate as a whole. When all this has been paid for there is little left for further progress. At the same time a large proportion of the valuable material now collected in the nursery is deteriorating owing to the delay in getting it permanently planted out. The new work necessary for the further laying-out of the estate and the permanent planting out of the nursery material is, in the main, paid for out of the grants made by the Society to the Gardens. The time is approaching when the whole of the present income will be needed for maintenance, and then, failing an increase in the available resources of the Botanical Society, either the Gardens must find another source for increased financial assistance or even the present slow rate of progress must be seriously diminished. The greater part of the permanent work already done at Kirstenbosch stands to the credit of the Botanical Society; if that work is continued without interruption there is no doubt that Kirstenbosch will in time become one of the noted Botanic Gardens of the world. Its ultimate fate seems at present to be in a particular sense in the hands of the Botanical Society. The Executive therefore makes an urgent appeal to the members of the Society to do everything in their power to increase the membership and income of the Society and to add to its power to ensure the continued development of the Gardens through what will certainly prove to be an anxious and difficult period.

W. Duncan Baxter, Chairman.

Theodora Amphlett, Hon. Secretary.

March 10th, 1915.

PROGRESS AT KIRSTENBOSCH

THE following summary statement of the principal work done in the Gardens since the beginning of 1914 is here recorded for the information of those members of the Society who are unable to keep themselves acquainted with the progress of the work by frequent visits to Kirstenbosch.

1. *Naming the Collections.*—This important work has advanced rapidly during the year, mainly owing to the assistance given by the Curator and Staff of the Bolus Herbarium of the South African College. We are, in addition, indebted to Dr. S. Schönland and Mr. F. Bolus.

2. *Survey.*—The survey of the northern three-quarters of the estate, kindly undertaken by Professor Snape, and carried out with the assistance of his staff and students, has been completed.

3. *Nursery.*—Specimens to the number of 5,159 were received during the year. These large additions have necessitated the construction of 800 ft. of new terracing in the nursery.

4. *Bulb Garden.*—Beds and paths over 1,000 ft. in length have been laid out and planted near the entrance gates. A mass of Richardias and Wachendorffias has been planted alongside the stream which runs through the bulb garden.

5. *Economic Garden.*—The experimental cultivation of Buchu, certain oil yielding seeds, and the Spek Boom has been commenced and is proceeding with satisfactory results.

6. *Fernery.*—The cost of construction has been defrayed by a grant of £350 from the Life Members' Fund of the Botanical Society. The stone for the upper twenty yards of the stream has not yet been obtained and some permanent construction around the old bath in which the spring issues has yet to be done, and the planting of the upper quarter of the length of the banks still awaits the arrival of suitable material. Otherwise the work is completed. About seven hundred tons of stone and two hundred loads of soil and leaf mould have been used. About seventy species of ferns, represented by 1,100 specimens—including fifty South African tree ferns—are planted, and show every sign of finding the conditions altogether favourable to most luxuriant growth. Many of the derelict oak trees which are now an eyesore will be removed as soon as the native shade trees planted beneath them are sufficiently advanced.

7. *Cycads.*—The collection of South African species of this extremely interesting and ancient group occupies a prominent space on the slopes above the well. About 300 specimens are already planted. In obtaining these we have been generously assisted by the Forest Department and by many private collectors ; the cost incurred has been largely defrayed by contributions from the President of the Botanical Society and Lady Rose Innes, Mr. H. W. Struben and Mr. W. Duncan Baxter, M.L.A.

8. *Chestnut Avenue.*—An avenue of ninety-two Cape Chestnuts (*Calodendron capense*) has been planted along the ancient roadway connecting the two principal ruins. The trees were presented by Mr. H. H. Bolus.

9. *Lawn.*—The lawn near the entrance has been increased by about two acres. A collection of Mesembrianthema has been planted along both sides of the roadway which skirts the south side of the lawn.

10. *Rockery.*—By the permission and with the assistance of the Department of Railways and Harbours, a rockery has been built on the platform at Newlands Station and planted with succulents. The laying-out of the natural rockery at Kirstenbosch and the planting out of the Aloe collection have been commenced. For these purposes a special grant of £200 from the Life Members' Fund has been made by the Botanical Society. *Specimens of Aloes for this rockery will be most welcome.*

11.—About three miles of fire paths have been cut, and other extensive clearings, which reduce the risk of fire in various parts of the estate, have been made.

12.—A hard road from Newlands Avenue to Kirstenbosch has been constructed by the Provincial Council. A new road from the top of the Kirstenbosch Hill to Wynberg Park is under construction.

MESEMBRIANTHEMA AS GARDEN PLANTS

DESEMBRIANTHEMUM, a genus including more than three hundred species very varied in habit, size, colour and cultural needs, includes many forms suitable for gardening purposes, which, under favourable conditions, thrive excellently with a minimum of attention. Given an open, well-drained site on a loamy soil the showiest kinds can be used liberally as edgings to drives and promenades. For clothing with foliage and flower, steep ugly corners where the usual run of garden flowers do not thrive, they fill a pronounced want. For dry banks, "dry walling" and rockeries they are eminently adapted. The great thing to avoid with these, as with other succulents, is a water-logged soil. If the site is liable to water-logging, even if only temporarily, provision must be made to avoid it. Artificial watering, even in summer, is undesirable, except perhaps in unusual cases, and with short-rooted plants like *M. calcareum*, *M. Hookeri* and their allies. On these the first season after planting a close watch should be kept, and if undue shrivelling is noticed, a sprinkling of water should be given, but as seldom as possible, as the roots will quickly penetrate deep enough to render the plant immune from the effects of even prolonged drought. With the "Mimic" and "Window Plants" of the Mesembrianthemums particularly, the great desideratum is to get the superabundant water away from them during the period of our cold winter rains. To secure this it is undesirable to resort to glass structures in their native land. Rather should this end be attained by the conformation of the ground and the consistency of the soil. The desired conformation will readily occur to everyone with the aid of the sites already mentioned. The consistency of the soil should be such that it more readily throws off the water than absorbs it. A free loam, well consolidated at planting, will best secure this condition, and will ensure a firm, ripe growth to flower in due season. In a loose, sandy soil, which absorbs water freely, the growth is quickly gorged with moisture, and during excessive cold the plants are liable to rot. Where the water-table of a sandy soil is at some depth from the surface, Fig Marigolds will do fairly well, for like other classes of South African plants they are exceedingly adaptable to unusual conditions. It should always be borne in mind that a luxuriant growth is not innate to these plants, and anything that tends to induce it should be avoided.

The chief requirements may be summed up briefly as :—An open, sunny, well-drained site, a dry, buoyant atmosphere, a free loam with a dressing of leaf-mould sufficiently consolidated to become somewhat impervious to water. The most favourable site, a rockery with well-defined "pockets," crevices, fissures, ledges and the many other intricacies that make up a good rockery.

The following are a few of the best of about two hundred species now in cultivation in the National Botanic Gardens, Kirstenbosch, and the purposes for which they are suitable.

"Edging."—The annual *M. criniflorum*.

"Bordering" and "Pockets."—*M. aureum*, *M. aurantiacum*, *M. glaucum*, *M. micans*, *M. speciosum*, *M. elegans* and *M. Mahoni*.

"Crevices."—*M. geminatum*, *M. lupinium*, *M. tigrinum* and *M. uncinellum*.

"Fissures."—*M. pygmaeum*, *M. vittatum* and *M. bellidiflorum*.

"Ledges."—*M. Lehmanni*, *M. robustum*, *M. obconellum*, *M. mustellinum*, *M. apiculatum*, etc.

"Massing."—*M. deltoides*, *M. purpureo-album*, *M. amœnum*, *M. floribundum*, *M. blandum*, and those recommended for bordering.

"Mounds and Slopes."—*M. reptans*, *M. coccineum*, *M. grossum* and *M. crystallinum*.

Among the oddities of the low fleshy-leaved kinds are *M. Bolusii*, *M. nobile*, *M. Pearsoni*, *M. Tugwelliae*, *M. lapidiforme*, *M. resurgens* and *M. simulans*.

J. W. M.

THE COLLECTION OF SPECIMENS FOR KIRSTENBOSCH

MEMBERS of the Society are invited to assist in stocking the Gardens with native plants. Specimens from all parts of Africa are desired. At present representatives of the following are particularly needed: *Aloes*, *Bulbs*, *Cycads*, *Ferns*, *Forest Trees* (seeds), *Protea* (seeds), *Heath* (branches bearing old flowers), *Euphorbia*, *Mesembrianthema*, *Cotyledon*, *Crassula* and *Stapelia* and medicinal and other economic plants.

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To

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National Botanic Gardens,
Kirstenbosch,
Newlands, Cape.

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The Botanical Society of South Africa

OBJECTS:

a) To encourage the inhabitants of South Africa to take an active part in the progress and development of the National Botanic Gardens at Kirstenbosch, a part of the Groote Schuur Estate, in the Cape Province, and to induce them to appreciate their responsibilities therein.

(*b*) To augment the Government grants towards developing, improving, and maintaining fully equipped botanical gardens, laboratories, experimental gardens, etc., at Kirstenbosch.

(*c*) To organise shows at which may be displayed the results of botanical experiments or cultural skill in improving the different variaties of South African flora.

(*d*) To enlighten and instruct the members on botanical subjects by means of meetings, lectures, and conferences, and by the distribution of literature.

FOUNDED JUNE 10th, 1913

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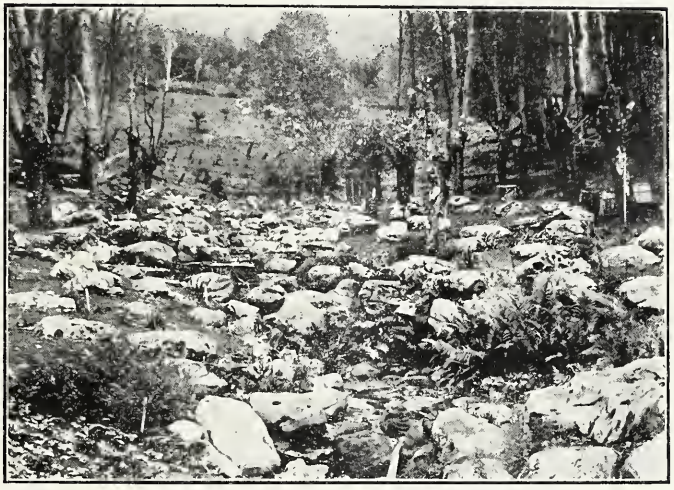
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Sympathisers wishing to become members of the Society are invited to communicate with the Hon. Secretary, P.O. Box 103, Cape Town.



A view of the upper half of the Fern Glen showing some of the stonework constructed with the financial assistance of the Botanical Society ;
Cycads on the slope above



A view from the top of the Aloe Garden now in course of construction

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THE ANNALS OF THE BOLUS HERBARIUM. A Journal of South African Botany. Edited by H. H. W. Pearson, M.A., Sc.D., F.L.S., Harry Bolus Professor of Botany in the South African College, Hon. Director of the National Botanic Gardens, Kirstenbosch.

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THE JOURNAL OF THE BOTANICAL SOCIETY OF SOUTH AFRICA

Edited by H. H. W. PEARSON,
M.A., Sc.D., F.R.S., Hon. Director,
NATIONAL BOTANIC GARDENS
:: :: :: KIRSTENBOSCH :: :: ::

Part II. 1916

Published under the authority of the Council of the Botanical Society



A large specimen of *Encephalartos latifrons* at Kirstenbosch.

The Journal of the Botanical Society of South Africa

PART II 1916

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Edited by H. H. W. PEARSON, M.A., SC.D., F.R.S., Hon. Director, National Botanic Gardens, Kirstenbosch

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OUR BOTANICAL GARDEN.

THE wonder is that we have done without a Botanical Garden, in the true sense, so long in South Africa. When we think for a moment on the richness of our flora, and the manifold contributions which this country has made to the nursery gardens of Europe, and how joyfully we buy back our own children of the soil, improved out of all recognition by the skill and toil of others, how must the bosom of the true nationalist swell with pride.

True enough in the days of that most energetic of Governors—old Simon van der Stel—the garden of the Company was a feature, and a great service was rendered in the acclimatization of many useful, and some extremely pernicious strangers from the far-flung possessions of the Dutch East India Company. The gardens in Cape Town and their surroundings are still the greatest attraction in our City, but they have for many generations ceased to make a pretence at filling the place of a true Botanical Garden, where the passing stranger might make the acquaintance of the treasures and the varieties of the South African flora. In saying this, there is no lack of appreciation of the praiseworthy efforts of the City Authorities, who have turned what was fast degenerating into a rather unkempt shrubbery into a well-kept pleasaunce—a comfort and joy to all ages and to every class in the community.

Where so much has been done, it seems invidious to play the part of the critic. And yet one might perhaps be allowed to suggest that an opaque glass-house and a massive statue in the Early Victorian style, that was surely designed for some site where a moderate distance would lend dignity to the conception, do somewhat detract from the vista that ought to be bounded by the Museum at one end and the Library at the other. The City Ædile who has done so much for the Avenue might well extend his beneficent attention to the central walk of our city gardens.

However, in the fulness of time, the reproach that has rested on South Africa has been lifted by the exertions of Professor Pearson and his coadjutors at Kirstenbosch, and we may well hope that they will do for us in the near future what Buitenzorg does for Java, and fill the breast of the passing visitor with a becoming envy of our indigenous floral resources. Certainly no more suitable site for such a purpose could be found.

Backed up by our incomparable mountain that stands up and takes the morning, the gorge of the Liesbeek, opening wide apart over a wealth of woodland, and the wide expanse of the Flats reveals the blue mountains of the inner land in the far distance. No one can gaze over that sur-

passing view without a grateful memory of Cecil Rhodes, whose lofty conception of the duties and the opportunities of great wealth has, for all time, snatched that heritage of beauty from the hands of the Philistines, in the shape of the building syndicate and the suburban villa.

Fortunate it is that the shaping of the conception is in capable and sympathetic hands, and that it will not be spoiled by the raw haste that presses for immediate results. The collection of plants takes time, and even skilled gardeners are not immune from the numerous disappointments that endear the gardener's trade to the amateur enthusiast. When completed we may hope that, as years go on, the visitor to Cape Town may be able to form some general idea of the flora of our country, while the student can pursue his investigations in a more suitable field than the text-book or herbarium. The culture of the orchids, the heaths, and the countless variety of indigenous bulbs that have for years enriched the floriculture of Europe, will no doubt form a feature in the work of the garden, and may, we hope, justify the epithet of " National " by breaking down, in some measure, the too exclusive monopoly of the exotic floriculturist in the hybridisation and improvement of our South African species.

A wide field stands open for the culture and study of economic and medicinal plants, to which too little attention has been devoted in South Africa. It is gratifying to see from the last annual report that already a beginning has been made in this useful and too-long-neglected work. It is to be hoped, that at no distant date, some real attempt may be made to have a thorough investigation of the various simples used by native herbalists, before the ruthless hand of progress has exterminated them and their professors. There is still a fine opening left for some Governor to obtain the useful immortality that adorns the name of " Cinchon," which ought to be remembered by countless numbers of grateful sufferers from fever. In this direction the medicinal and the commercial values of the various kinds of Bush Teas deserve more attentive study than they have hitherto obtained. There is, in fact, from the standpoint of utility, no limit to the possibilities opened up by our Botanic Garden, if it receives the aid that it deserves at the hands of those who profess to have a true pride in South Africa.

After all, however, the main object of the gardens is the cult of Beauty—the revelation to the children of this land, who are devoted to the worship of materialism, and who are taught to put a cash valuation upon the things of this life, of the undreamed-of possibilities that lie at their doors, too often uncared for and despised in the pursuit of vulgar substitutes. Great will be the achievement if, by some means, the lesson may be taught how to render the homes, which now lie scattered over South Africa, in all the naked simplicity of corrugated iron and untidy surroundings, more attractive and homelike, and to awaken an interest in the botanical treasures that nature has planted even in the most unattractive localities. He who accomplishes this feat will not only lift a reproach from the land, but he will do more to create a sense of national beauty and national feeling than if he made a hundred speeches.

And when all is said and done it will only be reviving a dormant sense. The Cape of Good Hope was settled about the time of the Tulipomania in Holland, by the same race who managed to combine economic gardening and horticulture in a way that obtained the admiration of Europe.

It was one of the wisest of Englishmen who wrote : " God Almighty first planted a garden. And, indeed, it is the purest of human pleasures. It is the greatest refreshment to the spirit of man, without which buildings and palaces are but gross handy works." It would be too much to say that, with all their energy, the Anglo-Saxon race have carried this lesson round the world.

We hope that brighter days in this respect are dawning on South Africa, and that Kirstenbosch may help to wipe away the reproach that lies upon us.

It is too much, indeed, to hope that we shall ever be able to say of that charming spot and of that enchanting view, with the poet :

" Fair quiet, have I found thee here ?
And innocence, thy sister dear,
Society is all but rude
To this enchanting solitude."

Alas ! the advent of the motor 'bus, hailed in the last report of the Director, forbids that hope ; but we shall do better ; we shall secure a harmless pleasure, and provide a refreshment for the mind and body of many thousand dwellers in the City, and hold up a lesson and an example for coming generations.

John X. Merriman.

THE JOURNAL OF THE BOTANICAL SOCIETY
of South Africa 2 (1916)

THE KIRSTENBOSCH CYCADS.

THE vegetation with which we live appears so exactly to fill the place which it occupies in the scheme of nature, that it is not easy to realise that it has not always been where it is. As a matter of fact, however, it represents, not a permanent condition, but a phase—a passing phase—in the evolution of plant forms from obscure beginnings to an unknown end. We possess records of earlier periods in the earth's history, when the types of plant life which at present force themselves upon our notice by their abundance were not yet in existence ; when the earth's vegetation was dominated by forms differing in many important characters from the flower and fruit-bearing plants of to-day. These earlier types have one after another yielded place to more successful races, and have either become extinct or have left comparatively few descendants, which have maintained an obscure place among the vegetation of to-day. Groups which have thus lost the importance they once possessed are the Club Mosses (*Lycopodium*), the Ferns,* the Horsetails (*Equisetum*), the Maidenhair Tree (*Ginkgo*) and the Cycads.*

The study of such plant groups as these not only throws light upon the condition of the earth's surface in earlier times, but, more important still, it enables us to draw conclusions regarding the course of evolution, the results of which we see in the vegetation of the present day. The materials for this study are found in the living descendants of these ancient races, and in their remains, preserved as fossils in the rocks.

The living representatives of these ancient groups are, for the most part, widely scattered over the earth's surface, and a comprehensive collection of any one of them in cultivation is, therefore, of particular scientific interest—the more so since by this means some of them are likely to be saved from speedy extinction. These are among the circumstances which have led to the bringing together of so many Cycads at Kirstenbosch.

There are to-day about 90 living species of Cycads. Nearly half of these are found in America, between Florida and Chili; about 30 occur in Australia, the islands of the Pacific and South and East Asia ; a few in Tropical Africa ; and 15 or more in South Africa, mostly in the South-East Coast belt between Port Elizabeth and the Tropic.

The South African species naturally fall into two groups or genera, viz., *Encephalartos* ("Zamia," "Kaffir Bread") and *Stangeria*. Of the 14 or more species of *Encephalartos* all but one

* These names are used in a broad sense.

or two can now be seen at Kirstenbosch. Some of them bear a general resemblance to small palms or tree ferns, for one or other of which they are not infrequently mistaken. Their stems, thick in proportion to their height, and densely covered by small scale leaves, and the persistent bases of the green leaves of former years, bear on their summits handsome crowns of long feather-like leaves. In other species the stem is entirely subterranean, or rises but a few inches above the ground ; it bears, however, a crown of leaves as in the former case. Cones, sometimes weighing as much as 30 lbs., stand above the leaves,* in some a single cone arising apparently from the apex of the stem, in others a ring of 2-6 regularly disposed around the centre of the crown. The cones are of two kinds, the smaller producing the pollen, the larger bearing the seeds ; these are never found together on the same plant.

The seeds of some appear to be more or less poisonous, at least in some stages of their development. The pith of the stem, on the other hand, was formerly used by the Hottentots as food. Thunberg, writing in 1772, says : " It is out of the pith of this tree (*Encephalartos Caffer*) that the Hottentots contrive to prepare their bread. For this purpose, after scooping out the pith, they bury it in the earth and leave it there for the space of two months to rot, after which they knead it, and make it into a cake, which, in their usual slovenly and filthy manner, they slightly bake in the embers." Another Cycad is, or was, similarly used in the East Indies and Ceylon.

A list of the species of *Encephalartos* now at Kirstenbosch is given below :—

E. brachyphyllus, Lehm. Coast forests.

E. villosus, Lehm. This is perhaps the most graceful of the species. It is common in the coast forests from East London to Natal.

E. sp. An undetermined species from Delagoa Bay.
E. caffer, Miq. Coastal districts from Uitenhage to Natal.

E. Ghellinckii, Lehm. Common on the Drakensberg, according to report occurring at all elevations, almost from sea level to about 8,000 ft. It is remarkable for its fine leaflets and the curious habit of its adult stem which lies on the ground or inclines against some conveniently situated rock.

E. sp. Small plants from Cookhouse. Name not yet known.

E. sp. Small plants with narrow leaflets from the Eastern Transvaal. Believed to be a new species.

* Two of the Kirstenbosch plants of *Encephalartos Altensteinii* are producing cones *below* the leaves. This is probably a consequence of the removal of the last crown of leaves when the plants were brought down from the Piric Forest.

E. latifrons, Lehm. A remarkably handsome species found in Albany and Bathurst. Its leaflets are broader than those of any other species. Two exceptionally fine specimens are seen midway up the slope, directly behind the well. The larger of these, standing 9 ft. above the ground, is certainly the largest specimen in cultivation (see frontispiece); it is said by those who know the locality from which it came that it is the largest in existence. This species appears to be on the verge of extinction. It is only known to occur in two localities, in which the plants are now very hard to find.

E. Lehmanni, Lehm. Coastal forest belt north of East London.

E. Altensteinii, Lehm. Coastal forest belt from East London to Natal. This familiar species is very common in Cape Gardens.

E. horridus, Lehm. Addo Bush.

E. sp. A very handsome species recently obtained from Bathurst. Name unknown.

E. Frederici-Gulielmi, Lehm. A species remarkable for the thick tawny wool covering the crown. Abundant on the doleritic hills near Queenstown, Cathcart and Thomas River.

In addition there are two specimens which may belong to one, perhaps two, of the preceding species, but which cannot yet be identified.

Stangeria, the second genus of South African Cycads, differs so much in appearance from *Encephalartos* that it is not at once obvious that it belongs to the same group. It resembles the ferns more closely perhaps than any other Cycad—in fact, when it was discovered in 1835 it was mistaken for a fern. Its stem is entirely below ground, and, unlike that of *Encephalartos*, it frequently branches freely. Probably only one leaf is produced each year, and each branch of the stem seems to bear only one cone at a time. Three forms of *Stangeria* are known, though it is doubtful whether they should rank as distinct species. They are all growing at Kirstenbosch, and we hope in due course to learn more of their relations to one another. Their names are :—

Stangeria paradoxa, Moore. This form is found in deep shade in the forests of the Transkei, Natal and Zululand.

S. schizodon, Bull. Shady forests in Pondoland.

S. Katzeri, Regel. Found in the open grassveld at East London, Kentani and elsewhere in the South-eastern Coast belt.

It will be obvious from what has now been said that at present it is impossible to say exactly how many species are included in the Kirstenbosch collection. At the least there are fourteen.

The collection comprises about 500 specimens. The photographs show that a number of them are yet without leaves ; the leaves which have appeared are small, because none of the plants have yet formed a complete root-system. In two years or less the plants already here should present a magnificent sight, which of itself will almost justify the special treatment which has been given to them.

But this is not the reason why the Cycads have been so favoured. Their real claim to distinction is based upon the scientific interest which attaches to them. It is, unfortunately, not possible in a necessarily brief, popular article, to give a comprehensive account of the reasons why the botanist is compelled to make so much of the comparatively few Cycads that occur in isolated areas dotted here and there in the warmer parts of the globe. All that can be attempted here is to draw attention to a few facts of outstanding importance.

In the first place we may notice that the Cycads are the last representatives of a race of great antiquity—in fact, if we claim that they belong to the most ancient race of seed-bearing plants still represented by living seed-bearing members, we run no greater risk than that of doing less than justice to the possibly (but not probably) prior claims of a single species, viz., the Ginkgo, of which something has already been said.

In discussing the part played by the Cycads in the composition of the earth's vegetation in the past, we have to deal with periods of time which we cannot even estimate with any sure approximation to accuracy. All that we can certainly say of them is that, measured by the units of which the short span of human life permits us to have any real knowledge, they are immense.

Plants and animals have existed on this planet through four so-called "geological eras," to which the geologist has given the following names, viz. :—(1) The *Paleozoic*, or *Primary ;* (2) *Mesozoic*, or *Secondary ;* (3) *Cainozoic*, or *Tertiary* , (4) *Post-tertiary*, or *Quaternary*, in which we are now living. The length of each of these eras is certainly to be measured in hundreds of thousands, in more than one case, more probably, in millions of years. We may consider very briefly the general character of the vegetation of Europe and N. America in each of these four ages, beginning with the most recent (the *Quaternary*), and working backwards.

During the early part of the present (*Quaternary*) period Northern Europe and America were passing through the ice ages. The ice sheet came down from the north, bringing with it the general conditions of an Arctic climate. Its southern edge at one time advanced southwards, at another receded northwards. This oscillation appears to have occurred at least four times, marking four distinct ice ages, separated by periods during which the northern hemisphere enjoyed a more genial climate. The plants and animals were driven south by the ice, or returned to the north as the climate moderated. At one time elephants and a hippopotamus reached the South of England ; at another the Arctic fox and the reindeer flourished as far south as Southern France and Switzerland. During these ice ages man seems to have made his first appearance in Central and Northern Europe, evidences of his presence being found mingled with the remains of the elephant, the rhinocerus and the hippopotamus. The vegetation of those times was essentially of the same type as that with which we are familiar. Probably the majority of the species living to-day were already in existence.

The Cycads, we may assume, were then very much what they are to-day, viz., a comparatively small and subordinate group confined to limited situations favoured by climatic and other conditions.

At the beginning of the *Tertiary* era Europe and the northern hemisphere generally enjoyed a warm climate. As it advanced the climate became more temperate and, finally, cold; at the end of the *Tertiary* age the conditions which led to the formation of the extensive ice-sheets of the early part of the Quaternary era were probably not far from being realised. As in the latter, so throughout the *Tertiary* era, the vegetation in the main resembled that of modern times, though its distribution, affected by the climate, was very different. The plants of Central Europe, in the first half of the *Tertiary* era, resembled those now found in warmer regions. They included palms, magnolias, acacias, figs, oaks, walnuts, gums (eucalyptus), laurels, conifers, and many other familiar forms. Two of these—the Proteas and Ginkgo—are of particular interest. The family of the Proteas, now almost confined to South Africa and Australia, was then fairly abundant in Europe, though no member of the family is indigenous there now. Ginkgo, of which two specimens are planted above the Cycads at Kirstenbosch, is now found wild only in China; in *Tertiary* times it seems to have been a common tree in Europe.

In later *Tertiary* times the warm climate forms retreated southwards before the oncoming cold, and the vegetation of Northern and Central Europe gradually became more like that which flourishes in similar climates in modern times, though many of the later *Tertiary* plants doubtless succumbed to the rigorous conditions of the *Quaternary* ice ages. In its general aspect, the *Tertiary* vegetation in those parts of the world in which its remains have been studied was modern. Indeed, that important part of our modern environment which is constituted by plant life was to a large extent well established before the end of the *Tertiary* era. The Cycads, so far as we know, were then subordinate in importance to higher types, as they are to-day.

The animal world was also a modern one. The *Tertiary* era has been called "The Age of Mammals," this group being then dominant, even more markedly so than it is now. Not only were the mammals represented by a great variety of forms, but some of them attained a great size. They included forms related to the elephant, rhinocerus, tapir, horse, wolf, opossum, antelope, pig, and many others which are familiar in these times.

The *Tertiary* followed upon the heels of the *Mesozoic* era, which is of exceptional interest to students of plants and of animals. The *Mesozoic* animals included corals in great number and variety, sea urchins, oysters, the ancestors of our lobsters, crabs and shrimps, insects of many kinds, including butterflies, and many fishes. But the predominant place among the animals was occupied by reptiles, of which there were many kinds, some of them of gigantic size. These creatures lived in the sea, some in fresh water, or on dry land; others, the *Pterosaurs*, or flying lizards, were related to the land saurians in much the same way as the modern bats are to the mammals. The crocodile, the alligator and the turtle are nearly related to these *Mesozoic* reptiles. That the descendants of other contemporary forms have entirely died out need cause no regret. Among these were sea lizards, such as *Ichthyosaurus* and *Plesiosaurus*, immense creatures probably frequenting the shallows along the coasts of the period. In later *Mesozoic* times there flourished numbers of aquatic snake-like animals, some of them 40 ft. in length. There are not wanting those who attribute

the persistency of the sea serpent legend, in modern times of peace, to the continued existence of a race of these *Mesozoic* marine snakes. Perhaps the most remarkable of the land reptiles of this "Age of Reptiles" were the *Dinosaurs*, some of which were carnivorous. It is said that some of these attained a stupendous size—anything from 25 to 100 ft. in length, and 10 to 30 ft. in height. A distinguished novelist, by an ingenious device, preserves alive the *Dinosaurs* and other horrific creatures of the time, and brings them into contact with man.* While his sketch of their habits is necessarily founded upon such knowledge of their structure as is furnished by their fossilised remains—judiciously assisted by a fertile imagination—he has hardly exaggerated the horror which the animal life of the period would have engendered in the mind of man, but, fortunately, man was not yet there.

Towards the end of the *Mesozoic* times the reptiles lost their predominant position. Many of the forms which had flourished earlier in the period were already extinct, and of those that remained the numbers were diminishing. Their place among the beasts of the field was gradually filled by the mammals, a group already of long standing, which, as we have seen in the *Tertiary* era, became, and to this day has remained, the dominant group of animals.

The earlier *Mesozoic* vegetation would have been less shocking to our sense of proportion than the animals which lived amongst it, but, nevertheless, it would have appeared very remarkable to the eye of a modern observer. Instead of the flowering plants which in *Tertiary* and recent times have played so conspicuous a part in the earth's vegetation, the dominant forms then were relatives of the Cycads, the Yellow woods, the Maidenhair Tree (Ginkgo), the ferns and other forms at present unknown in the living state, or represented only by obscure descendants. The Cycad-like plants of this period were so numerous in proportion to the other forms of vegetation that the *Mesozoic* age has been called the Age of Cycads. Their remains occur in England, Spitzbergen, Sweden, France, Italy, elsewhere in Europe, and especially in North America, where they are found in great abundance, frequently in association with the remains of gigantic reptiles. These Cycads of the *Mesozoic* period resembled those of to-day in their general appearance, and until a few years ago were not known to have differed in any marked manner from the modern plants. A closer study of them, rendered possible mainly by the discovery of the fossilised remains of many species in North America, has shown that the majority of the so-called Cycads of that epoch were in many important respects different from any that we know in the living state. But although the fossils of this period have not yet yielded conclusive evidence of the presence of Cycads in all respects like those of the present day, the indirect evidence that they were in existence then is very strong.

Towards the end of the *Mesozoic* period the Cycads and their associates gradually gave place to a more modern type of vegetation, whose remains are indistinguishable from those of the living poplars, oaks, fig, walnut, magnolia and other familiar trees which, as we have seen, came to their own in the later *Tertiary* era. The periods of time involved in these considerations we cannot measure, but we cannot fail to be impressed by the thought that the competition, still maintained between the Cycads and the more highly organised and more recent vegetation of the Transkeian forests, was inaugurated untold ages ago, when the dominant Cycad-like forms of the *Mesozoic* era first came into contact with a new vegetation, whose descendants were destined to throw them

* A. Conan Doyle—*The Lost World*.

and their contemporaries so completely into the shade. As the Reptiles yielded to the Mammals, so the Cycads gave place to the Dicotyledons.

Going still further back in the earth's history to the end of the *Paleozoic* era, we find in the Permian rocks traces of what were probably the earliest Cycads, from which the many forms characteristic of the *Mesozoic* era, as well as the few that are with us still, are descended. Of the origin of these Permian Cycads we have no certain knowledge, but there is evidence that they were related to the ferns, and probably in particular to a large and peculiar group of *Paleozoic* ferns now quite extinct, which bore true seeds.

Thus, while there are gaps in the chain of evidence—but perhaps not more than we should expect considering the nature of the facts which furnish it—we are led to the reasonably safe conclusion that the Cycads now flourishing on the slopes at Kirstenbosch represent a family which originated in the *Paleozoic* era, probably from a group of fern-like plants. They have survived the ruin of other types, both plant and animal, which at one time or another in their long history have flourished beside them.

The distinction which thus belongs to the Cycads, by virtue of their long descent, does not of itself give them the importance they possess in the eyes of the student. This depends rather upon the light which they shed upon the course of plant evolution. If there were no living Cycads, and if Ginkgo, the last remaining member of another ancient race, were also extinct, our present knowledge of the way in which the great advance from the type represented by the ferns to that of the seed-bearing plants took place would be even more inadequate than it is.

Everyone knows that the living ferns do not bear seed. The appearance of the seed brought into existence a new race (or races) of plants which have since attained a remarkably dominant position among the lower types of vegetation. Therefore a group which may be said to represent the lowest type of seed-bearing plant still existing is of particular interest to the botanist. The living Cycads constitute such a group. The interest attaching to them is the greater because, in so many respects, they resemble the ferns. The fact that they are so commonly mistaken for tree-ferns is a proof of this resemblance. They are, of course, at once distinguished from ferns by the fact that they bear seed. When this is not obvious, the resemblance has sometimes been close enough to deceive a botanist—as in the case of Stangeria referred to above. In these cases the likeness is in superficial characters only. But in certain minute characters of structures concerned in reproduction, they show far more striking indications of affinity with the ferns. The Cycads are therefore correctly regarded as establishing a link between the ferns and the higher seed-bearing plants. They thus do something—and may yet do more—to bridge over what has hitherto been a wide gap in our knowledge of the evolution of the higher plants.

Perhaps these few remarks will enable us to regard the Cycads with a greater interest than before ; to realise that the Kirstenbosch collection, now almost complete as far as South African species are concerned, is one of great value from a scientific and educational point of view, and, therefore, one which commences to realise the object with which the bold attempt to transform Kirstenbosch into a National Botanic Garden was undertaken.

HISTORY OF KIRSTENBOSCH ESTATE.

THE following note on the history of the Kirstenbosch Estate, kindly supplied to me by the Registrar of Deeds, may prove of interest to the readers of the Journal of the Botanical Society.

WM. BISSET BERRY, M.L.A.

House of Assembly,
Cape Town, 17th June, 1916.

The land now forming the property known as Kirstenbosch originally formed two distinct properties, viz.: —

(*a*) "A piece of 107 morgen 1 square rood and 72 square feet, described as situate in the Cape district between the Government place Kirstenbosch and those of H. D. Maynier and W. Versfeld at the foot of the mountain of the so-called Agter Tafelberg," which was granted to Christopher Bird on the 10th January, 1811. (No. 64, Vol. 6, Cape Freeholds.)

(*b*) "A piece of 107 morgen and 450 square roods of land situate in the Cape district," granted to Henry Alexander on 2nd July, 1811. (No. 83, Vol. 6, Cape Freeholds.)

Note.—In the diagram attached to this grant the land is described as "Nevenstaande figuur Zijnde Gouvernements plaats Kirstenbosch is gelegen in het Kaapsche District").

Subsequently, on the 16th June, 1817, a diagram embracing both pieces of land was framed and filed of record, and thereon appears a certificate in the following terms :—"These are to certify that the above diagram represents the land belonging to the place Kirstenbosch, situate in the Cape District." According to this diagram the original extent of the place Kirstenbosch was 214 morgen and 456 square roods, but certain portions were subsequently transferred, and the remaining extent now vested by Act 9 of 1910 in the Government of the Union of South Africa is 152 morgen, 96 square roods.

There is nothing on either side of the deeds of grant, or diagrams, that explains how the name of Kirstenbosch came to be applied to the land.

It may be mentioned, however, that one Jan Frederik Kirsten mortgaged, on the 3rd June, 1796, his farm " Veldhuisen " (now Feldhausen Estate), which forms part of what is now Claremont, which is not far distant from Kirstenbosch. Possibly this Kirsten, or some other member of the family, may have leased the land described in paragraph (*b*) above, before it was granted and the name have been given to it on that account. Other places in the vicinity are also named after individuals apparently, as, for example, Claasenbosch and Burgersbosch. Or may it not possibly be the case that the places in question were named after estates in Holland ?

Claasenbosch was first granted to a Versfeld, but it also may have been leased to a Claasen prior to being granted.

No search has been made in regard to Burgersbosch.

It has been suggested to Professor Pearson, Director of the National Botanic Gardens, that the name Kirstenbosch is a corruption of " Kersenbosch," Kersen meaning cherries ; but such evidence as there is does not go, it seems, to support this view.

PROGRESS AT KIRSTENBOSCH.

THE following summary statement of the principal work done in the Gardens since the beginning of 1915 is here recorded for the information of those members of the Society who are unable to keep themselves acquainted with the progress of the work by frequent visits to Kirstenbosch.

1. The laying out of the Aloe Garden on the natural rockery west of the lawn is now considerably advanced. The cost of the work has been defrayed by grant of £200 by the Botanical Society, as announced last year. *Specimens of Aloes for this rockery will be most welcome.*

2. An extensive system of surface drainage has been laid along the eastern slopes of the rockery, and a water supply has been carried through these slopes to the higher parts of the lawn. These works have been paid for by a special donation of £200 from the Trustees and others interested.

3. With the continued assistance of the Union Department of Forestry, the Cycad collection has been almost doubled in extent during the year. The expenses incurred have been defrayed by donations from the President of the Botanical Society and Lady Rose-Innes, Mr. W. Duncan Baxter and the late Mr. H. W. Struben.

4. The construction of the Bolus Orchid Garden has been carried far enough to accommodate all the ground orchids (about 80 species) in the collection. The cost has been defrayed by a donation from Mr. H. H. Bolus.

5. The Buchu crop is well established and is being extended. The experimental cultivation of *Madia* and other oil-yielding plants, and of Spekboom and certain "Bush-tea" and forage plants, is proceeding.

6. A large collection of Bulbs has been planted on the Southern slopes above the Fern Glen.

7. A formal terrace has been laid out along the western edge of the lawn. On the other side of the promenade, which runs parallel with the terrace, informal beds have been planted, or are being planted, with the Pelargonium and Oxalis collections.

8. Owing to the sympathetic attitude of His Honour the Administrator and of the Trustees of the Bishopscourt Estate, the danger of spoiling the gardens by deviating the Rhodes Road to the west of its old line has been obviated. The difficulty occasioned by the steep gradient of the Kirstenbosch Hill will be overcome by a deviation eastwards through the Bishopscourt Estate; this deviation is now under construction.

PRESS CUTTINGS.

The first number of the Journal of the Botanical Society of South Africa has recently been published It includes a short notice of the late Lord de Villiers, the first President of the Society, to whose interest and influence the establishment of the gardens and the founding of the Society was so largely due. An interesting account of former public and private acclimatisation and botanic gardens at the Cape, with an outline of the establishment in 1913 of the National Botanic Garden at Kirstenbosch, is also given. It is a matter of regret that this important enterprise seems likely to suffer financially owing to the war, just when funds are so essential for furthering the initial stages of its development. It is to be hoped that the Botanical Society, to the assistance of which the new National Garden owes so much, will continue to bear its share in the responsibility of developing the garden as generously as in the past, and will be able to enlist many new members to help on the work.—*Nature*, September, 1915.

On and after January 1, 1916, the following fees will be charged, in the interests of national economy, for admission to the Royal Botanic Gardens, Kew : On Mondays, Wednesdays, Thursdays, Saturdays, Sundays, and Good Friday, 1d. ; on Tuesdays and Fridays, except Good Friday (students' days), 6d. ; a charge of 3d. is made for the admission of photographic apparatus. Bath-chairs will be permitted to enter the gardens during public hours when the condition of the paths is suitable, on payment of 1s. on students' days (Tuesdays and Fridays, except Good Friday), and on payment of 6d. on other days.—*Nature*, December, 1915.

In the Royal Botanic Gardens, Kew, some twenty-five large trees were uprooted during a storm which raged over England on March 27 and 28 last. Among these, unfortunately, were several of the best representative specimens of their kind in the garden, and at least two of the best recorded specimens in the country. Several smaller trees were blown down, or were so severely damaged that their removal is inevitable. Other large trees had limbs torn away, leaving them permanently disfigured, while hundreds of trees and shrubs were blown out of the upright and will need supports.

The Temple of the Sun (near the main entrance gates from Kew Green) was destroyed by the fall of the 75-feet high Cedar of Lebanon. There is a dramatic touch in the fact that these two important features should have originated and ended together. The Temple was built in 1761, and the Cedar is said to have been brought from the Duke of Argyle's garden at Whitton and planted during the same year.

The last of the " Seven Sister " elms lies a wreck uprooted by the storm. Tradition credits the planting of these trees to the seven daughters of George III.—*Gardeners' Chronicle*, April, 1916.

The Government of British Columbia has presented to the Royal Botanic Gardens, Kew, a magnificent spar of Douglas fir to replace the old flagstaff, which was taken down in 1913 owing to decay. The suggestion to present a really fine specimen of a Douglas spar was made by Mr. J. H. Turner, the late Agent-General for British Columbia, and was readily taken up by the Premier and the Government of British Columbia. This suggestion, made in the autumn of 1913, has now definitely materialised, and the spar, which was loaded on to the R.M.S. "Merionethshire" in August, 1915, arrived in the Thames at the close of last year, and was moored in the river off Kew Gardens on January 3. The spar was logged from the lower mainland coast of British Columbia. The tree selected measured 220 ft. in length, 6 ft. in diameter at the large end, and 18 inches in diameter at the small end. The log was loaded on a logging railway and hauled ten miles to salt water, being taken by a tug to Vancouver. There it was hewn to its final shape, making it 215 ft. in length, 33 in. at the butt, and 12 in. at the top. Its weight is about 18 tons. The spar was brought from British Columbia on the deck of the "Merionethshire," and its loading was accomplished with some difficulty. Its erection in the Royal Botanic Gardens will be an operation of considerable magnitude.—*Nature*, January, 1916.

According to the official figures, the attendance of the public at the Royal Gardens, Kew) in 1915 was 4,300,330, an increase of 218,319 over last year's total. The greatest monthly attendance was during May, the figures being 1,031,802, which included the highest single-day record for the year—Whit-Monday, May 24th, 175,830.—*The Journal of the Kew Guild*, 1916.

The work of completing the laboratory building and first range of plant houses at the Brooklyn Botanic Garden is now proceeding. We learn from *Science* that the completion of these buildings at this time has been made possible by the donation, by three friends of the garden, of £20,000, on the condition that a like sum be appropriated for the same purpose by the City of New York.—*Nature*, February, 1916.

We regret to learn, through a letter from Mr. J. Jones, the Curator, that the Island of Dominica was visited by a very heavy gale on the night of August 10th, which caused a great deal of damage in the Botanic Gardens and also in other places. About 100 trees, some of large size, were uprooted, and many others lost their tops or some portion of their branches. Unfortunately a number of species of which there was only a single specimen have been destroyed.

Mr. Jones writes that it will be a long time before the grounds can be put in proper order ; but a generation at least must elapse before the gardens can be fully restored to their condition before the gale. The photographs accompanying the letter are sad records of the devastation which has been caused.—*Kew Bulletin*, 1915.

In commemoration of the 25th anniversary of the founding of the Missouri Botanical Garden by Henry Shaw in 1889, a celebration was held at Missouri on October 15-16 of last year, to which American and foreign botanists were invited to attend and contribute papers. The anniversary Proceedings have recently been issued in a volume of 400 pages, and form Vol. 1, Nos. 1 and 2, of the Annals of the Missouri Botanical Gardens.—*Nature*, November, 1915.

Drug Production in Queensland.—The Board of Agriculture of the Colony of Queensland is making experiments to ascertain whether certain drugs, of which a shortage is being felt owing to the war, cannot be grown in the Colony. A scheme is being prepared and ample funds will be forthcoming. The experiments will be carried out on practical lines in conjunction with the hospital.—*Gardeners' Chronicle*, February, 1916.

The Botanical Society of South Africa.

OBJECTS:

(*a*) To encourage the inhabitants of South Africa to take an active part in the progress and development of the National Botanic Gardens at Kirstenbosch, a part of the Groote Schuur Estate, in the Cape Province, and to induce them to appreciate their responsibilities therein.

(*b*) To augment the Government grants towards developing, improving, and maintaining fully equipped botanical gardens, laboratories, experimental gardens, etc., at Kirstenbosch.

(*c*) To organise shows at which may be displayed the results of botanical experiments or cultural skill in improving the different varieties of South African flora.

(*d*) To enlighten and instruct the members on botanical subjects by means of meetings, lectures, and conferences, and by the distribution of literature.

FOUNDED JUNE 10th, 1913

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Associate Members enjoy all the privileges of Membership except that they do not vote at any of the Society's Meetings.

Honorary Members may be elected at a Meeting of the Society on the nomination of the Executive.

Sympathisers wishing to become members of the Society are invited to communicate with the Hon. Secretary, P.O. Box 70, Cape Town.

THE ANNUAL REPORT OF THE BOTANICAL SOCIETY FOR THE YEAR 1915

THE Executive is glad to be able to report that, notwithstanding the disturbed condition of affairs in this country, the position of the Society has been well maintained.

At the Annual Meeting on March 30th, 1915, the Rt. Hon. Sir James Rose-Innes, K.C.M.G., was elected President of the Society, and the following Vice-Presidents: Sir Lionel Phillips, Bart., Sir Lewis Michell, K.C.V.O., and the Hon. W. P. Schreiner, K.C., C.M.G.

The following were elected as the Executive for the year:—

Wm. Duncan Baxter.	Miss Fairbridge.
G. B. van Zyl.	Lady Rose-Innes.
Dr. Pearson.	Mrs. Carter.
Adv. R. W. Close.	Mrs. McPherson.
J. Storr Lister.	Eustace Pillans.
Maynard Nash.	F. Cartwright.

Mrs. G. T. Amphlett was elected Hon. Secretary, but resigned the appointment on leaving for England in June, and Mr. Frank E. Cartwright has since undertaken the duties as Acting Hon. Secretary. There have been six meetings of the Executive during the year.

The Membership Roll now stands at—Family Members, 26; Ordinary Members, 263; Associate Members, 32; Life Members, 46. The addition to the list of Life Members is particularly satisfactory.

It is with great regret that the Council have to record the death of Mr. H. W. Struben.

During the year it was deemed necessary to strike off the names of several members who failed to carry out their obligations of subscription, and the Executive would again urge upon the Society the necessity of increasing the number of members, as it is obviously by this means alone that the main object for which the Society was created can be achieved, viz., to assist the development of the National Botanic Gardens. Co-operation in this regard is all the more necessary now, inasmuch as the Government last year found it necessary to reduce the amount of their grant to the Gardens by £250.

Under the auspices of the Society, Prof. E. J. Goddard, B.A., D.Sc., of Stellenbosch, delivered a lecture in the City Hall on June 18th, 1915, on "The Botanic Gardens of Sydney, N.S.W." This lecture proved to be of a very interesting character.

The Council was "At Home" to members of the Society at Kirstenbosch on Saturday, February 26th, 1916. A very large number of members and their friends availed themselves of

this opportunity of seeing the progress which had been made during the year in the development of the National Botanic Gardens. The Society was honoured by the presence of Their Excellencies the Governor-General and Lady Buxton on this occasion.

During the year the Society published its first Journal, copies of which were sent to all members and most favourably received. The preparation of this publication was undertaken by Dr. Pearson, to whom the thanks of the Society are due.

From the published accounts it will be observed that a sum of £252 12s. 0d. has been available during the year from Current Revenue for the Trustees of the National Botanic Garden.

The amount at credit of the Life Members' Fund is now £575. A grant of £200 was made during the year towards the establishment of a Karoo Garden at Kirstenbosch, and the Executive feel sure that members will endorse their action in voting this money towards a permanent improvement at the National Botanic Gardens.

The Executive desire cordially to acknowledge their obligations to the Press for valuable assistance in reporting matters of interest and calling attention to the work of the Society.

Wm. Duncan Baxter, Chairman.

Frank Cartwright, Hon. Secretary.

March 14th, 1916.

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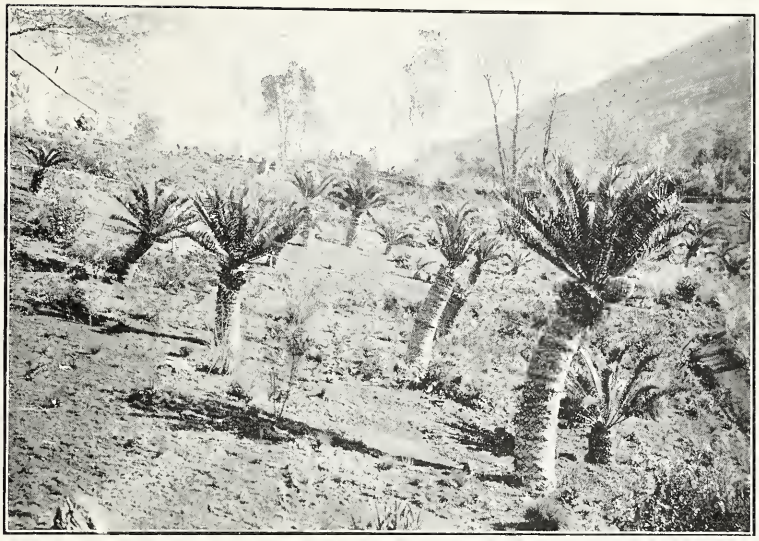
THE ANNALS OF THE BOLUS HERBARIUM. A Journal of South African Botany. Edited by H. H. W. Pearson, M.A., Sc.D., F.R.S., Harry Bolus Professor of Botany in the South African College ; Hon. Director of the National Botanic Gardens, Kirstenbosch.

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Two groups of *Encephalartos Altensteinii* at Kirstenbosch


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The Journal of the Botanical Society of South Africa

PART III. 1917

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In Memoriam.

DR. H. H. W. PEARSON, M.A., S.D., F.R.S.

Hon. Director National Botanic Gardens, Kirstenbosch, Professor of Botany, South African College.

Born 28th January, 1870. Died Nov. 3rd, 1916. Buried at Kirstenbosch, Saturday, Nov. 4th, 1916.

Henry Harold Welch Pearson was born at Long Sutton, Lincolnshire, on the 28th January, 1870. He received his school education privately and proceeded to Cambridge in 1893. His record as a student was brilliant ; he took first classes in Parts I. and II. of the Natural Science tripos and was elected Darwin Prizeman at his College—Christ's. He became the Worts travelling scholar and visited Ceylon in 1897-98. It is interesting to note that in 1915 a Ceylon planter on a visit to South Africa came to see Dr. Pearson to tell him how valuable had been the work done in Ceylon.

On his return to Cambridge in 1898 Dr. Pearson was appointed Assistant Curator of the Herbarium of the University, and was elected Frank Smart student in Botany at Caius College. In 1899 he was awarded the Walsingham Medal for botanical work, and in the same year he accepted a post at Kew.

He began his South African career in 1903, when he was appointed first Harry Bolus Professor of Botany at the South African College. There had been previously a Chair of Botany at the College, but it had lapsed in 1889, and Dr. Pearson came to a botanical department which had no students, no laboratory, no equipment. His first work was to advise the College in connection with the erection of a botanical laboratory. The building was opened in 1905, and since that date the numbers in the department have steadily increased. Dr. Pearson was always an enthusiastic and successful teacher, a strict disciplinarian, and during the period of his professorship he turned out almost yearly advanced students in botany. Many of these have now made botany their life study.

Very soon after his arrival in Cape Town Dr. Pearson began a series of botanical expeditions into different parts of South Africa ; he gave particular attention to Namaqualand, Damaraland and the adjoining regions. His primary object was the observation of Welwitschia Mirabilis in the South-Western Protectorate and the collection of material for laboratory study. He made three journeys for this purpose. Probably his greatest journey was in 1908-9, when he also visited Angola, and there contracted fever, which probably was the first attack on a constitution never robust. It was in these journeys that Dr. Pearson got to know South Africa and its people as it and they are known to few of us. He had a fund of stories of his experiences and a wealth of sympathy with the farmer—he was himself a farmer at heart—whether fighting the desert or struggling in Angola to retain his language and his religion.

So far as this Society is concerned Dr. Pearson was best known by his work in connection with the establishment and development of the National Botanic Gardens at Kirstenbosch. European botanists had for almost a century pointed out the unique opportunity the Cape offered for the establishment of a botanic garden, one which would inevitably become known throughout the world. Dr. Pearson himself had always before him the desirability of founding a garden, and in 1910 at a meeting of the South African Association for the Advancement of Science he devoted his presidential address to Section C to the subject of a South African National Botanic Garden. He worked strenuously in the matter, and finally, in 1913, with the assistance in particular of Sir Lionel Phillips, he saw the Garden launched. He had achieved where many had tried and failed. It is not necessary for me to go into detail regarding the development of the Garden ; you have seen it grow before your eyes and have had the privilege of hearing Dr. Pearson himself explain what were the lines on which to work.

Dr. Pearson had at the time of his death already received from his colleagues in the world of botany recognition as one of the chief workers in the subject. He was a contributor to various periodicals, and had published about fifty papers in the Journal of the Linnæan Society, Phil. Transactions and Proceedings of the Royal Society of London, in the Proceedings of the Royal Society of South Africa, the Reports of the British and the South African Associations for the Advancement of Science, the Annals of Botany, the Geographical Journal and other well-known periodicals. The Royal Society elected him a Fellow in the year he died, and other honours would in the natural course of events have been his.

I have tried in these few words to tell you what Dr. Pearson did as a teacher, a traveller and a botanist. That by no means exhausts the enumeration of his activities. He had very strongly pronounced views on what a University should be and do, and he kept these ideals before all of us at the Council of the University of the Cape of Good Hope and at the meetings of the Senate of the South African College. He edited the Annals of the Bolus Herbarium and the Journal of the Botanical Society. He was engaged on a book at the time of his death. Indeed, his life was in late years almost too full.

In conclusion, I should like to say a few words about the man apart from his works. To his friends his loss cannot be adequately expressed. It is rare, indeed, that men of his seriousness and earnestness of character retain so completely an almost boyish power of enjoyment such as he had. He never got into the unprogressive groove of routine teaching ; he was happy in having the experience and the knowledge without ever losing his ideals. To-day, when the cry for research resounds throughout the land, one is glad to be able to say that during his whole life Dr. Pearson kept before himself and all others the best ideals of academic work. His example was an influence we in South Africa in particular can ill afford to lose.

J. C. BEATTIE.

THE SOUTH AFRICAN PROTEACEAE.

THE *Proteaceae* form a very natural group of plants in the vegetable kingdom, and may be divided into two large groups, mainly on the character of the fruit. In the first group the fruit is usually a nut, more rarely a drupe (cf. *Brabeium stellatifolium*, the Wild Almond), and does not split open to allow the seeds to escape. The Silver Tree (*Leucadendron argenteum*), Waaboom (*Protea grandiflora*), and the Kreupelboom (*Leucospermum conocarpum*) are typical examples of this group. The second group comprises those members of the family in which the fruit is a capsule, *i.e.*, the ripe fruit opens and allows the contained seeds to be dispersed. Examples of this group may be seen in the Silver Oak (*Grevillea sp.*) and species of *Hakea* cultivated in South Africa. Besides this main division into two distinct groups the family is subdivided into seven Tribes, but the limitations of these Tribes need not concern us here. Not only is the division into the two groups, as indicated above, a natural one, but it corresponds to a great extent with the geographical distribution of the family. Members of the *Proteaceae* are found in Australia, South Africa, New Caledonia, the Indian Archipelago, Tropical Asia, and Japan ; in the Western Hemisphere a few species are native to South America. None of the *Proteaceae* are indigenous to Europe. All the African species belong to the " nut-fruit " group, the American and Asian species to the " capsule-fruit " group, while members of both groups are found among the Australian *Proteaceae*.

That the *Proteaceae* had a wider distribution in former geological times we know from fossil evidence. During the first part of the Tertiary period, when the climate of Europe was more or less tropical and plants such as palms, magnolias, etc., flourished there, the *Proteaceae* were probably fairly well represented. Proteaceous-like plants resembling the living species of *Petrophila* and *Isopogon* were supposed to form part of the lower Eocene vegetation, but their occurrence is not proved. In the next formation, the Oligocene, the flora of the period contained the proteaceous shrubs *Dryandra*, together with such plants as *Ficus*, *Aralia*, *Sequoia*, *Eucalyptus*, etc., while at a still later period fossil plants referred to the genus *Hakea* are found in the Pliocene formation in the South of France and in the Vienna Basin. We know that fossil plants, undoubtedly *Angiosperms*, have been found in early cretaceous deposits and it appears safe to assume that a primitive group such as the *Proteaceae* must also have existed then. There is however no fossil evidence to support this. During the late Tertiary and early Quaternary periods when the Northern Hemisphere came under the influence of the Ice Age, the tropical plants and animals were forced to retreat southwards or were exterminated, and it is more than likely that it was at this time that the *Proteaceae* became extinct in Europe. The origin of the *Proteaceae* in South Africa is still a matter for conjecture,

but it seems quite feasible to think that under the influence of the northern cold they were driven southwards in three divergent lines into the extremities of the Southern Continents, South Africa, Australia, and South America, and then evolved in each country along lines of their own into the present-day forms.

The bulk of the world's species, numbering about 1,000, is massed in Australia and South Africa, approximately 550 species in the former country and 300 in the latter, *i.e.*, about 85% of the known species are confined to the two sub-continents, the remaining 15% being distributed in the countries enumerated above. In Australia the family is far better represented than in South Africa, as out of 50 known genera, 29 are found in Australia, and these contain members of each of the seven Tribes into which the *Proteaceae* are divided. In South Africa we have only 14 genera, 13 of which all belong to one Tribe. There is no African member of the family native to Australia or *vice versa*.

It was to be expected that the South African *Proteaceae* very soon engaged the attention of European botanists when material was brought to Europe by the early navigators and collectors who touched at the Cape. The first reference in botanical literature we have of a member of the family is in 1605, when Clusius figured a head of a *Protea*, now known as *P.neriifolia*, and it was not until 1696 that a second figure appeared which represented a seedling and cone of the Silver Tree. Between the years 1700 and 1800 the *Proteaceae* were largely cultivated in European gardens, and in 1720, a Dutch botanist, Boerhaave, published descriptions and figures of 23 species, which work constitutes the first serious attempt to describe all the species known at the time. It was the custom in botanical literature of this period to designate plants by a short Latin description, *e.g.*, the Silver Tree was known as *Conocarpodendros foliis argenteis sericeis latissimis*, the binomial system of nomenclature whereby every plant has two names, that of the genus and species as *Leucadendron argenteum*, etc., had not been invented. The latter system was introduced in 1735 by the great naturalist Linnæus who first used the names *Protea* and *Leucadendron*. Following Linnæus, the later botanists referred nearly all the species of *Proteaceae* to either of the above genera, and it was not until 1809 that Salisbury proposed the names for new genera to include species which obviously did not belong to either *Protea* or *Leucadendron*. Salisbury described 190 species of *Proteaceae* mostly cultivated in the garden of a Mr. Hibbert at Clapham, and which were collected at the Cape by Niven. The year following Salisbury's publication saw what is commonly regarded as the classic on the *Proteaceae*, viz., Robert Brown's monograph in the "Transactions of the Linnæan Society." Brown accepted the limitations of most of Salisbury's genera, but gave them new names which are accepted at the present day. The South African flora was at this time receiving much attention in Europe, and collectors, especially Drege, Ecklon, Krauss, Ludwig, and Zeyher sent large collections of *Proteaceae* to European herbaria. This accumulation of material was taken in hand by a German botanist, Dr. Meisner, who in 1856, published the descriptions of 279 species from South Africa, and his monograph, until six years ago, remained the standard work on this group. The latest publication is in that part of the "Flora Capensis" which appeared in 1911 and where 14 genera and over 300 species are described. Since this time, however, descriptions of new and rare species have appeared at intervals.



1 *Spatalla longifolia*, Kn. **2** *Protea Dykei*, Phill. **3** *Serruria Knightii*, Hutch. **4** *Diastella ericaefolia*, Kn.
5 *Leucadendron minus*, Phill. and Hutch, var. *gluborscens*, P. and H. **6** *Orothamnus Zeyheri*, Meian (Photo by E. J. Steer).
7 *Mimetes hirtu*, R. Br. **8** *Nivenia Sceptrum*, R. Br. **9** *Leucopermum attenuatum*, R. Br.
(Photos by E. P. Phillips).

The genera of *Proteaceae* found in South Africa are the following :—

Brabeium	1	Species.
Aulax	3	,,
Leucadendron	60	,,
Protea	85	,,
Leucospermum	33	,,
Faurea	5	,,
Mimetes	10	,,
Orothamnus	1	,,
Diastella	5	,,
Serruria	50—60	,,
Spatallopsis	5	,,
Sorocephalus	13	,,
Nivenia	13	,,

Of the above 14 genera and over 300 species, 11 genera and nearly 300 species are confined to the south-western region of the Cape Province. The genera *Protea* and *Faurea* extend to the Eastern Province, the Transvaal, and Tropical Africa, and one species of *Leucospermum* is said to occur in tropical Africa. The *Proteaceae* thus form a very important constituent of the south-western flora and are popularly united with the heaths and bulbs as being the three characteristic groups in the "Cape" flora. The heaths, proteas, and "bulbs" comprise over 20% of the flora of the south-western region, the *Proteaceae* contributing almost 5%.

The South African *Proteaceae* differ very greatly in habit. Some of the species are creeping plants (c.f. *Serruria spp. Leucospermum hypophyllum*), others are bushes (cf. *Protea spp. Leucadendron spp.*) while some assume the dimensions of large trees (cf. *Faurea spp.* and the Silver Tree), yet they agree in the following two characters which are common to all the species. The flowers are usually massed in heads and have only four perianth segments, and the stamens are situated in spoon-like depressions at the apex of the perianth lobes (see Figs. A to G). These characters enable one to recognise at a glance a member of the family. The individual genera, more especially *Protea*, exhibit the same diversity of habit as is found in the family generally. Some species of *Protea* have only a subterranean stem so that the "flower head" and leaves arise at the ground level (*e.g., P.lorea* from French Hoek), others are bushes or small trees (*e.g. P.mellifera, P.grandiflora*). In leaf characters, size, shape, and position of the "flower heads" the same protean character is manifested.

In a paper such as this it is not possible to describe in any detail the various genera and a few general remarks must suffice.

Brabeium : Represented by only one species, *B.stellatifolium*—the Wild Almond. It differs from all the other South African species by having the leaves in whorls of six and a drupaceous fruit. The genus occupies an isolated position among the African *Proteaceae* and is more closely related to some of the Australian and Tasmanian genera. The species is fairly common in the Western Province along the banks of streams. Specimens may also be seen at Kirstenbosch.

Aulax : In *Aulax* the stamens and " pistil " are borne in separate flowers on distinct plants *i.e.*, the species are dioecious. Frequently found on the mountains of the Western Province. At one time a species was native to Table Mountain but has now disappeared. The male flowers in the genus are arranged in spikes and not in the heads, as is usual in most of the South African genera.

Leucadendron : This genus together with *Aulax* differs from all the other South African *Proteaceae* in being dioecious (see Fig. B). The fruit is borne on a cone somewhat resembling that of a Pine, and exhibits various devices as an aid to wind distribution. In this respect mention should be made of the fruit of the Silver Tree where the fruit, together with the remains of the perianths escape from the cone and form a beautiful parachute arrangement. Many of the species have densely hairy leaves (*e.g.*, the Silver Tree), while in others (*e.g.*, *L.grandiflorum*) the leaves are perfectly glabrous. Some of the species in which the upper leaves surrounding the female cones are brightly coloured, are exceedingly handsome.

Protea : In the genus *Protea* the flowers are grouped into a head which is surrounded by a number of coloured bracts called an " involucre " (see Fig. A). The Sugar Bush is the best known example of a *Protea* and is the only species in which the bracts are viscid. In the Giant Protea (*P.cynaroides*) the leaf is distinctly divided into an orbicular blade and a cylindric leaf-stalk, and among the 85 species of *Protea* is the only one which has a stalked leaf. A few Proteas are found in the Eastern Province, while one species (*P.Rouppelliae*) is very abundant in Natal and takes the place there of the Sugar Bush of the Western Province. The genus also extends into Tropical Africa and is represented there by about 30 species, all of which, with one exception, are different from the South African species.

Leucospermum : Species of *Leucospermum* are frequently mistaken for Proteas, but can easily be distinguished by the following character. In *Leucospermum* the lobes of the perianth segments are always free, *i.e.*, four lobes each containing an anther are distinguishable, whereas in *Protea* three of the perianth segments are fused together, the fourth remaining free (see Figs. A and F). The leaves of a great many species of *Leucospermum* are dentate round the apex, but no species of Protea has toothed leaves. The Kreupelboom (*L.conocarpum*) may be taken as a typical representative of the genus.

Faurea : This genus comprises plants which are either trees or shrubs, and differs from all the other South African genera, with the exception of *Brabeium* and the male plants of *Aulax*, in having the flowers arranged in spikes or racemes. The genus is better represented in Tropical Africa than in Southern Africa, and one species is native to Madagascar. (This is the only proteaceous plant found in Madagascar.) *Faurea saligna*—Beukenhout and *F. MacNaughtonii* —the Terblanz are the best known species.

Mimetes : In the genus *Mimetes* the heads only consist of 3—12 flowers and are situated in the axils of the upper leaves and partially hidden by them. In this respect it differs from all the other genera and so is easily recognised. In *M. hirta* the bracts surrounding the flowers are brightly coloured ; in *M. lyrigera* it is the subtending leaves which give the plant a showy appearance.

Orothamnus : Like *Brabeium* this species only contains a single species, viz., *O.Zeyheri* which was formerly placed under *Mimetes*. The species has a very restricted distribution, only being known from the Hottentot's Holland Mountains. Carl Zeyher first found the plant about 80 years ago and since that time it has only been recorded twice—from a flower-seller's basket in Adderley Street. It is a very striking plant with large red bracts surrounding the flowers. Its exact habitation has not been found yet though systematically searched for.

Diastella : A genus included by Brown and Meisner under *Mimetes*, but it differs sufficiently in habit and floral characters to warrant separation as a distinct genus. They are creeping or erect shrubs, and compared with other members of the *Proteaceae* are of no particular beauty. Two species are found on the Cape Peninsula.

Serruria : The most conspicuous species of this genus is *S.florida*—the "White Protea" or "Blushing Bride." It is confined to a very restricted locality in the mountains round French Hoek and is there represented by not more than 100 specimens. The species should be included among those South African plants which are so rare that they are in danger of extinction. Fortunately, it has been successfully grown at Kirstenbosch and will flower there this year. The remaining species of *Serruria* are mostly small shrubs with divided leaves resembling those of a *Hakea*.

Spatalla : All small shrubs with needle-like leaves. The heads contain 1 or 3—4 flowers and are arranged in spikes on a common peduncle.

Spatallopsis : A small genus resembling *Spatalla* in habit but differing in small floral characters.

Sorocephalus : The species of *Sorocephalus* differ from those of *Spatalla* and *Spatallopsis* in having the flower-heads arranged in a globose manner and not in spikes as in the two former genera. There are also structural differences in the flowers.

Nivenia : Some species of *Nivenia* exhibit a character in their leaves known as dimorphism. The lower leaves on the branch are divided in a pinnate manner as, *e.g.*, the leaves of *Hakea*, while the upper leaves are quite entire and more or less fan-shaped. Each head contains 4 flowers and the heads are arranged as a spike on a common peduncle.

This short paper may serve to show the importance of the *Proteaceae* in the South African flora and their scientific value. As yet we know little or nothing about the life history of the various species. By bringing together a collection of living representatives of *Proteaceae* for study purposes and also preserving them for posterity, Kirstenbosch will be fulfilling, in one direction at least, its role of a National Botanic Garden. A beginning has been made with the "Protea" collection. An area about two acres in extent has been reserved for members of this group, and at present there are 17 species growing, several of them coming into flower. Besides the species which have been planted out, a number of species native to the Peninsula have been self-sown and will soon be established.

E. Percy Phillips.

PROGRESS AT KIRSTENBOSCH.

THE following summary of the principal work done in the Gardens since the beginning of 1916 is here recorded for the information of those members of the Society who are unable to keep themselves acquainted with the progress of the work by visits to Kirstenbosch.

1. An area of over two acres immediately behind the Cycad Amphitheatre has been cleared of pines and a collection of 400 plants of Proteaceae from tins planted out during March. The plants have been mainly raised from seed, and include 10 species of Protea, 5 Leucadendrons, and 1 Mimetes, besides many as yet undetermined species.

2. The formation of an Aquatic Pond has been carried as far as the excavated soil would form and grade its banks. The water surface obtained is about four thousand square feet, and varies in depth from two inches to two feet six inches. The water was turned in on Christmas Eve, and the available material will be planted during the winter season. Small sluice gates have been made to control surface water during rains, and the streams leading into, from and around the pond to the lower edge of the lawn, a length of one hundred and sixty-five yards, have been stoned and grouted in cement to prevent further washaways.

3. Further space on the Aloe Kopje has been filled up during the year by 138 contributions, a liberal increase due no doubt to the special appeal in last year's journal. Thirteen contributions of Gasterias, 8 of Haworthias, and 3 of Apicras make up a valuable increase in the succulent Liliads. Numerous bulbs have also been transferred to their positions on this site.

4. The Cycad collection has been increased by 19 contributions of 93 specimens, including some of the largest and best plants in the collection. Six species of Australian Cycads have also been received, and fine examples of the Florida Cycad.

5. Fifty contributions, including several new species, have been added to the collection in the Bolus Orchid Garden.

6. The area under Buchu has been increased by over a quarter acre, and it is hoped thereby to be able ultimately to comply with requests for supplies of seed.

7. The lawn has been extended on the north side, towards Skeleton Ravine Stream, by turfing and planting an additional half acre.

8. A further 134 yards of the pathways in the Aloe Kopje have been paved and guttered, and 11 rough stone steps fixed where required.

9. The kerbing, guttering, and underground drainage of the area adjoining the formal terrace has been completed, and a stone-packed foundation laid and the surface gravelled.

10. The deviation of the Rhodes Road to the east, to overcome the gradient of Kirstenbosch Hill, is now nearing completion.

THE NATIVE TREES AND TREE-SHRUBS OF KIRSTENBOSCH.

THE trees and arborescent shrubs native to Kirstenbosch group themselves into those of the open mountain-slopes and those of the gorges. Not that there is any hard and fast line between the two divisions, for there are some that wander from their more natural folds in the ravines to mingle with those on the sunnier slopes and there assume a more shrub-like habit. With the exception of the silver-tree, the rule is, therefore, that all which deserve the title of trees are found in or near the ravines.

Nor is it easy in practice to make a nice distinction between large shrubs and trees. For there is every gradation between the typical *shrub*—say of not more than 20 ft. in height, which branches from the base, having no one stem strongly predominating over the others, and the typical *tree*, usually more than 20 ft. in height, which branches well above the base and has one definite main stem or trunk.

Of the trees on the mountain-sides and lower foot-hills, the silver-tree, or witte-boom (which being translated into Greek is *Leucadendron*), stands first in our affections. We who live here feel a thrill of pride at the mention of the silver-tree, for are they not confined to the Cape Peninsula and do we not share their beautiful home ? The lady, who said emphatically of the Cape about a hundred years ago : " There are *no trees*. The silver-tree is the loftiest indigenous plant which I saw," was no doubt thinking of the more usual shade-giving trees of Europe and elsewhere, and had not become reconciled to the idea of one that was actually light-giving instead. It is wonderfully beautiful, when the breeze sweeps over a branch, to watch the light playing among the leaves as each one successively responds to the touch of the wind. Dr. Marloth, in his " Flora of South Africa " (Vol. I, 145), explains how this brilliant effect is produced.

Silver-trees are first met on Wynberg Hill, and extend from there all along the ridge and its slopes into Kirstenbosch, till they come to a dead stop at the gum plantation. Those growing on the slope above the Nursery have been delivered from the clutches of their arch-enemy, the cluster-pine, but will no doubt continue to bear the marks of the struggle to their dying day. There are, however, many young trees coming on, and the old associations, killed by the pines, are reforming. For although silver-trees often grow in masses, yet there is always a dense undergrowth right up to their very boles. Keurkjes, both the large rose pink and the smaller pink and cream one (*Podalyria calyptrata* and *P. argentea*) ; the tall royal-blue *Aristea* (*A. capitata*) and the lower pale blue one (*A. spiralis*) ; the large, deep pink *Watsonia* with drooping flowers (*W. rosea*) ; belladonnas ; bracken ; blue *Scabiosa ;* yellow *Senecio* (*S. lineatus*) ; wild irises (*Moraea ramosa* and *M. glaucopis*) ; small sweet-smelling moon-flowers (*Silene clandestina* and *S. Burchellii*) ;

fragrant wild buchu (*Diosma vulgaris*); orchids (*Satyrium lupulinum* and *S. odorum*); April fool (*Haemanthus coccineus*); zurings (*Oxalis bifida, O. livida, O. polyphylla*, etc.); grasses (*Andropogon hirta, Ehrharta Rehmannii, etc.*); blue *Salvia* (*S. Africana* and *S. paniculata*)—these and many others form a tangle of varied charm and beauty.

July is the sweetest time for silver-trees, when the tips of the branches are putting out the new leaves, which surround the young flower-heads, and the silver gleams with a light as of mingled sun and moon—so bright and yet so soft it is. Then you may see the long-tailed sugar-bird (*Promerops caffer*) aloft on the tallest tree, his tail gently waving in the breeze as he "stands up and takes the morning." Below in the black-bearded protea bush (*P. Lepidocarpodendron*), with its richly honied-flowers, is his mate, and he will come fluttering down to her presently, making a great display of that fine tail of his.

Besides those on Silver-tree Ridge there is a picturesque scattered group, all among the common mountain-heather (*Erica hirtiflora*) on the northern side of Skeleton Gorge. They have a cloistral appearance as compared with their brothers and sisters in more exposed situations, and have been called "the nuns going to their chapel in the rocks above." Another company grows on the knoll below the granite and wild aloes.

On the slopes, and especially on those between Skeleton Gorge and the trolley-track, are the familiar blobs of grey, each of which means a waaboom, or wagon-tree (*Protea grandiflora*). They are indistinct on a bright sunny morning, sometimes disappearing entirely, but always conspicuous in the afternoon lights. The flower-heads are large and wide open and have creamy-coloured bracts. It is interesting to note the position of the leaves with regard to the light. Instead of having their flat surface at right angles to the rays of the sun, by means of a half-twist at the base, they assume a position of edge-on, so that the rays strike their flat surface obliquely. There is, therefore, no defined greener upper and paler under surface as in the *dorsiventral* or *bifacial* type of leaf. Teachers will find this a convenient example of the *isobilateral* type.

The kreupelboom (*Leucospermum conocarpum*) is not so easily seen on the slopes from a distance as the waaboom, nor does it occur so frequently. When each of the younger branches is tipped with its golden bristling ball of flowers it is indeed a handsome sight. The leaves are thick in texture and the sturdy branches numerous and well covered with overlapping leaves, and if one cannot rest *beneath* the shade of a kreupelboom one can do so in its shadow. For shelter it is one of the best, and when one's spirits are down and the wind blows cold, to get on the lee-side of a kreupelboom is to—

* "quite forget
What thou among the leaves hast never known,
The weariness, the fever, and the fret
Here, where men sit and hear each other groan;
Where palsy shakes a few, sad, last grey hairs,
Where youth grows pale and spectre-thin, and dies;
Where but to think is to be full of sorrow
And leaden-eyed despairs;
Where beauty cannot keep her lustrous eyes,
Or new Love pine at them beyond to-morrow."

* Keats' "Ode to a Nightingale."

and to say with Wordsworth :—

" Ye blessed creatures, I have heard the call
Ye to each other make ; I see
The heavens laugh with you in your jubilee ;
My heart is at your festival,
My head hath its coronal,
The fulness of your bliss, I feel—I feel it all."

Bergsapree (*Widdringtonia cupressoides*) occurs sparingly on the slopes. A good example may be seen on the contour path, just as it emerges from the dense growth of Window Gorge and the view opens out before one. This and the yellow-wood belong to the large group of " cone-bearers " (*Coniferae*). Economically, the *Coniferae* are valuable, " furnishing a large proportion of our timber, as well as resins, tars, turpentines, etc." Their distribution, too, is interesting. In the tropical forests they are almost entirely absent, while in the Northern and Southern Hemispheres they form important constituent parts in the forest vegetation. In the north there are the larches, firs, yews, pines, junipers, cedars, cypresses, the gigantic *Sequoia* and others, while among the southern conifers we have the Kauri or Cowrie pine, the monkey-puzzle tree, Norfolk Island pine, *Podocarpus* and *Widdringtonia*. In S. Africa there are three species of each of the last two genera, of which two are native to Kirstenbosch.

Widdringtonia is usually classed with the pines in the Order *Pinaceae*, notwithstanding the fact that their small closely-appressed leaves look very different from the " pine-needles " and the two pairs of scales which fit together (*valvate*) to form the female cone are a contrast to the numerous over-lapping (*imbricate*) ones of the pine. They are alike, however, in the fact that each scale bears two seeds, and that the male and female cones are on the same plant (*monoecious*). The male cones are very inconspicuous, the stamens that form them being similar to the foliage-leaves. The pollen is distributed by wind, as are also the winged seeds.

The Kirstenbosch yellow-wood is the oprecht geelhout, or rough-barked or broad-leaved yellow-wood (*Podocarpus latifolius*). It belongs to the same Order as the yew and the Gingko, *Taxaceae*, and has the male and female flowers or cones on different plants (*dioecious*). The former is composed of a number of coloured over-lapping stamens, each with two pollen-bags, and the latter is not a hard, dry cone at all. It is usually made up of three pairs of scales, of which *one* or *two* project above the rest, each bearing one seed, while the four or five sterile scales normally become fleshy and form the birds' " bonne bouche " and the botanists' *podo*, or " receptacle," on which the *carpus*, or fruit, stands. Excellent pictures and drawings of our two conifers are given in Dr. Marloth's " Flora of South Africa " (Vol. I., Plate 17 and Figs. 65 and 67).

There are several moderately good specimens of *Podocarpus* along the contour path. Perhaps the one that can be seen to the best advantage is near the upper end of the path that breaks off from the contour path and leads down the northern side of the Skeleton Gorge, joining the Window Gorge path at the belladonnas. It is a female plant.

But the yellow-wood has brought us to the three gorges—with their trees like rivers gently flowing down and gaining breadth as they go. Each has its own special charm—Nursery Gorge, its path winding up in the green and its fine bastion of rock, casting varying shadows all through the day ; Skeleton, its deep northern side, where leucadendrons splash the emerald with gold in winter, and the leaves of the rooibessie glitter in the sun and the olive branches are like white lines in the dark green ; and Window has its red rock with the trees all round it and up against it, and its queenly cunonias.

There is only one species, *Cunonia capensis*, in South Africa, found in moist, woody places throughout the Cape Province. Three other species occur in New Caledonia. Dr. Marloth* says it makes beautiful furniture and that it has been used in the little English Church at De Doorns for that purpose. The plant was so named by Linnæus, the generic name being "in honour of John C. Cuno, of Amsterdam, who described his own garden in Dutch, in 1750." Among the Peninsula trees it is the only one that reaches the summit of Table Mountain, though it is rather stunted when it does get there. It branches very regularly, sending off two opposite shoots on each side of the main shoot ; and when it has fair play it forms an ample, rounded, rich-looking tree, with large, glossy, gracefully-spreading leaves, and attains a height of 50 feet. The leaf-stalks and younger portions of the stem are usually tinted with red, which no doubt partly accounts for one half of the name—rooiels, or red alder. The leaves are usually composed of three pairs of leaflets and an odd terminal one, and the two united stipules afford an excellent example of how effectually young buds may be protected. They are often called "mustard-spoons" by children, who love to open them and look for the roughness at the base, where the "butter" is made. The cream-coloured flowers come in March and April and are pleasantly scented. They are small and very numerous, with ten projecting stamens, and are arranged in "bottle-brushes" up to eight inches long—quite the handsomest inflorescence of all the trees in Kirstenbosch, while that of the keurboom (*Virgilia capensis*) is the sweetest.

As in the case of *Cunonia*, there is only one species of *Virgilia*, found along river- or stream-banks in various parts of South Africa. "Keur" means choice, and apparently the original Dutch name has never been translated into English. It seems almost untranslatable. Its botanical name, in honour of the poet Virgil, was given by the great Lamarck, "the founder of evolution"† and "more than a systematic biologist of the first order." His countrymen called him the French Linné. He was born at Bazentin-le-Petit, quite near Longueval and Delville Wood. Did any of our South Africans know that through the sweet keurboom and Lamarck the land of their birth was linked with that of their death ? Did they know that he who gave our keur its beautiful name was also a soldier ; how as a lad of 17 "he bought himself a wretched horse for want of means to buy a better one and rode across the country to join the French army then campaigning in Germany" ; how on the break of day on the 16th July, 1761, "when the Colonel rode along the front of his corps the first man to meet his gaze was the new recruit, who had placed himself in the front rank of a company of Grenadiers" ; how he distinguished himself that day so that he was promoted

* "Common Names of Plants," p. 5.

† A. S. Packard, "Lamarck," p. 1.

Key to the Native Trees and Tree-Shrubs of Kirstenbosch.

Leaves less than $\frac{1}{4}$ in. long. — *Widdringtonia cupressoides*, Endl.
Leaves more than $\frac{1}{4}$ in. long.
 Leaves in whorls of 6. — *Brabeium stellatifolium*, L.
 Leaves not in whorls of 6.
 Leaves compound.
 Leaves opposite. — *Cunonia capensis*, L.
 Leaves alternate. — *Virgilia capensis*, Lam.
 Leaves simple.
 Leaves alternate.
 Leaves sessile.
 Leaves glabrous.
 Leaves grey-green, more than $\frac{1}{2}$ in. wide. — *Protea grandiflora*, Thunb.
 Leaves dark green, about $\frac{1}{2}$ in. or less wide. — *Podocarpus latifolius*, R. Br.
 Leaves hairy or silky.
 Leaves entire. — *Leucadendron argenteum*, R. Br.
 Leaves toothed at the apex. — *Leucospermum conocarpum*, R. Br.
 Leaves petiolate.
 Leaves with entire margins.
 Leaves with hooked spines in their axils. — *Scutia indica*, Brogn.
 Leaves without spines.
 Leaves about $\frac{1}{2}$ in. long, margins recurved. — *Phylica buxifolia*, L.
 Leaves more than $\frac{1}{2}$ in. long, margins flat.
 Leaves with swellings in the axils of the veins. — *Ocotea bullata*, E. Mey.
 Leaves without swellings.
 Leaves hairy on the under surface.
 Leaves dark green and shining. — *Royena lucida*, Thunb.
 Leaves pale green or drab. — *Tarchonanthus camphoratus*, L.
 Leaves glabrous on the under surface.
 Primary nerves more than 12 pairs. — *Myrsine melanophloeos*, R. Br.
 Primary nerves less than 10 pairs.
 Mid-rib raised on the upper surface of leaf.
 Fruit smooth. — *Gymnosporia laurina*, Thunb.
 Fruit with appendages. — *Pterocelastrus tricuspidatus*, Sond.
 Mid-rib sunk on upper surface of leaf.
 Leaves acutely acuminate. — *Ilex capensis*, Sond. and Harv.
 Leaves more or less obtuse. — *Apodytes dimidiata*, E. Mey.



M.M. Page del.

Leaves of the Native Trees and Tree-Shrubs of Kirstenbosch.

Plate II.



M.M. Page del.

Leaves of the Native Trees and Tree-Shrubs of Kirstenbosch.

Plate I.

Leaves with serrate or irregular dentate margins.
Leaves with spines in their axils.
Branches angular ; leaves obtuse. *Gymnosporia buxifolia*, Szysz.
Branches terete ; leaves acuminate. *Scolopia Mundtii*, Arn.
Leaves without spines in their axils.
Leaves when broken across showing white silky shreds. *Gymnosporia acuminata*, Szysz.
Leaves not as above.
Petioles of the younger leaves glabrous.
No primary nerves starting from the base of the leaf. *Scolopia Mundtii*, Arn.
Two primary nerves besides the mid-rib starting from the base of the leaf. *Celtis rhamnifolia*, Presl.
Petioles of the younger leaves pubescent.
Blade usually oblong, acuminate. *Kiggelaria africana*, L.
Blade ovate, obtuse or scarcely acute. *Grewia occidentalis*, L.
Leaves opposite.
Leaves stipulate.
Leaves pubescent. *Plectronia Mundtii*, Pappe.
Leaves glabrous. *Plectronia ventosa*, L.
Leaves exstipulate.
Leaves entire.
Leaves on the under surface with hairy pits in the axils of the veins. *Olea foveolata*, E. Mey.
Leaves not as above.
Leaves lanceolate, bronze and scurfy on the under surface. *Olea verrucosa*, Link.
Leaves not as above.
Young branches angular, white. *Olinia cymosa*, Thunb.
Young branches terete, green.
Leaves broadly ovate or oval, obtuse.
Leaves pale green, margins slightly revolute. *Olea capensis*, L.
Leaves dark green, margins flat. *Cassine Maurocenia*, L.
Leaves ovate or oblong, acute or acuminate. *Olea laurifolia*, Lam.
Leaves serrate or irregularly toothed.
Petioles and veins of the younger leaves clothed with shaggy brown hairs. *Curtisia faginea*, Ait.
Petioles and veins glabrous.
Leaves lanceolate. *Hartogia capensis*, Thunb.
Leaves ovate.
Leaves leathery, rather obtuse, rigidly serrate. *Elaeodendron Kraussiana*, Bernh.
Leaves membranous, acuminate, minutely serrate. *Halleria lucida*, L.

NOTE.—*Solanum giganteum*, Jacq., with large pale hairy leaves and purple flowers, although sometimes attaining the size of a small tree, is scarcely woody enough to be included in this list.

L. BOLUS.

EXPLANATION *of* PLATES.

PLATE I.

(See Page 18).

Fig. 1. Kersenhout, Spekhout, Wild Peach. (*Kiggelaria africana*, L.)
,, 2. Klipdoorn, Roode Peer, Red Pear. (*Scolopia Mundtii*, Arn.)
,, 3. Kruisbesje. (*Grewia occidentalis*, L.)
,, 4. Lepelhout, Ladlewood. *Elaeodendron Kraussiana*, Bernh.)
,, 5. Pendoorn. (*Gymnosporia buxifolia*, L.)
,, 6. Kat-doorn, Drach-mijn-keel. (*Scutia indica*, Brogn.)
,, 7. Smalblad, Lepelhout. (*Hartogia capensis*, Thunb.)
,, 8. Waterboom, Cape Holly. (*Ilex capensis*, Sond. and Harv.)
,, 9. Zybast, Silk-bark. (*Gymnosporia acuminata*, L.)
,, 10. (*Phylica buxifolia*, L.)
,, 11. (*Gymnosporia laurina*, Szyszyl.)
,, 12. Hard Peer, Hard Pear, Roodebesje. (*Olinia cymosa*, Thunb.)
,, 13. Aasvogelbesjes, Hottentot Cherry. (*Cassine Maurocenia*, L.)
,, 14. Kersenhout, Cherrywood. (*Pterocelastrus tricuspidatus*, Sond.)
,, 15. Keurboom. (*Virgilia capensis*, Lam.)
,, 16. Roode Els, Red Elder. (*Cunonia capensis*, L.)
,, 17. Assegaihout, Assegaiwood. (*Curtisia faginea*, Ait.)

PLATE II.

(See Page 17).

Fig. 1. Beukenhout, Cape Beech. (*Myrsine melanophloeos*, R. Br.)
,, 2. Schaapendrolletjes, Turkey-berry. (*Plectronia ventosa*, L.)
,, 3. Zwart Yzerhout, Black Ironwood. (*Olea laurifolia*, Lam.)
,, 4. Zwartbast, Black-bark. (*Royena lucida*, Thunb.)
,, 5. Siriehout, Camphorwood. (*Tarchonanthus camphoratus*, L.)
,, 6. (*Lauridia reticulata*, E. and Z.)
,, 7. Yzerhout, Bastard Ironwood. (*Olea foveolata*, E. Mey.)
,, 8. Klip Els, Kloofhout, Rock Alder. (*Plectronia Mundtii*, Pappe.)
,, 9. Olyvenhout, Wild Olive. (*Olea verrucosa*, Link.)
,, 10. Wagenboom, Wagon Tree. (*Protea grandiflora*, Thunb.)
,, 11. Yzerhout, Ironwood. (*Olea capensis*, L.)
,, 12. Oudehout, Witte Olyve, White Olive. (*Halleria lucida*, L.)
,, 13. Kreupelboom, Goudboom. (*Leucospermum conocarpum*, R. Br.)
,, 14. Witteboom, Silver Tree. (*Leucadendron argenteum*, R. Br.)
,, 15. Stinkhout, Stinkwood. (*Ocotea bullata*, E. Mey.)
,, 16. Camdeboo Stinkwood. (*Celtis rhamnifolia*, Presl.)
,, 17. Regte Geelhout, Yellow-wood. (*Podocarpus latifolius*, R. Br.)
,, 18. Berg Cypress, Bergsapree, Sapreewood. (*Widdringtonia cupressoides*, Endl.)
,, 19. Wilde Amandel, Wild Almond. (*Brabeium stellatifolium*, L.)
,, 20. Witte Peer, White Pear. (*Apodytes dimidiata*, E. Mey.)

" on the field to the rank of an officer." He died old and blind, and his remains " were thrown into a trench apparently situated apart from the other graves," so that " the exact site of the grave is and for ever will be unknown," as will that of many of our bravest.

Haller, after whom Linnæus named our oudehout or witolijf (*Halleria lucida*) was a Swiss botanist and a contemporary of Lamarck, who wrote that, while botany was languishing in France, " Linné in Sweden, Dilwillen in England, Haller in Switzerland, Jacquin in Austria, etc., have immortalized themselves by their own works, vastly extending the limit of our knowledge in this interesting part of natural history." The specific name, *lucida*, refers to the glossy appearance of the leaves. It belongs to the order *Scrophulariaceae*. *Halleria* is quite common at Kirstenbosch and is, perhaps, the daintiest of our trees—the young twigs making long light sprays of delicately-veined leaves, tapering into " drip-tips." The flowers are a dull red, about an inch long, and much larger than those of any other tree. Sometimes they occur singly, or a few together, in the axils of the leaves and sometimes in clusters on the bark of the older branches or trunk. The berries turn a deep purple and, according to the traveller Burchell, were much eaten by the Hottentots. Now, the red-winged spreeuw or rooivlerk (*Amydrus morio*) probably knows more of their flavour than any other consumer in Kirstenbosch.

Zwartbast, or black-bark (*Royena lucida*) belongs to the same order (*Ebenaceae*) as the famous Ceylon ebony tree. It is to be seen all over the Gardens, sometimes as a low, sometimes as a tall shrub, but in the gorges it becomes a tree attaining 30-40 feet in height. It has rather small, egg-shaped, highly polished leaves and solitary (*i.e.*, singly in the axil of the leaves) cream-coloured flowers, less than half an inch long. In the fruiting stage, however, the calyx increases in size up to an inch in length, like that of the " Cape gooseberry," and, becoming inflated, encloses the ripening fleshy fruit. This characteristic has given the Zwartbast the name of " African bladder-nut."

Of the *Celastraceae*, the order to which the well-known spindle tree of Europe belongs we have *seven representatives at Kirstenbosch, comprised under the five genera *Gymnosporia*, *Elaeodendron*, *Hartogia*, *Cassine*, and *Pterocelastrus*. The zybast, or silk bark (*Gymnosporia acuminata*) seems to be the largest tree in this group. It has dark green leaves, rather thin in texture, tapering into a " drip-tip," and always shows silky threads when the leaves are broken cross-wise. Miss Duthie, who examined the leaves, informs me that " the *silkiness* of the leaf is due to an elastic gum present in secretory sacs which are associated for the most part with the vascular bundles. The *threads* dissolve completely in xylol, benzol, etc., and are, of course, entirely different from those of some monocotyledonous leaves where they represent the spiral thickenings of vessels." The latter may be seen well in the leaves of *Brunsvigia gigantea*, the candelabra lily.

Pterocelastrus tricuspidatus is one of the trees or tree-shrubs known as kersenhout, or cherry-wood, and is interesting as being the possible origin of the name " Kersianbosch," as it appears

**Lauridia reticulata*, E. and Z. probably occurs in the ravines, but so far we have not succeeded in finding it. Fig. 6 of Plate II., therefore, appears somewhat prematurely or should not figure at all among the native trees of Kirstenbosch.

in the early documents and, later, Kirstenbosch. But, according to Pappe, the wild peach, or spekhout (*Kiggelaria africana*) was also called kersenhout, probably because the seeds displayed in the fruit as it splits open, are a bright red. It is doubtful, therefore, from which of the two the name has been derived.

By far the largest of the four olives is *Olea laurifolia*, the black iron wood of which there are a number of good specimens. On the contour path, on the northern side of the Window Gorge, just at the point where, after two zigzags, the path continues in a northerly direction past some Hottentot cherry trees, and in a southerly towards the trolley track, stands perhaps the finest of the black iron woods, with a trunk girth of over 9 feet. From a mighty anchorage of partially-visible roots the straight trunk rears itself and towers above the neighbouring oaks with its huge branches. What a magnificent view could be opened up just here of the distant flats, mountains and bay, with this king of Kirstenbosch, freed from exotic growth, exposed in all its strength and glory against the blue of the sky!

Amid the all-pervading beauty of Kirstenbosch there are yet spots, bearing some special charm, which arrest the attention and call for a more particular designation. One of these is the Celtis Glade in Window Gorge, a few paces above the second crossing of the stream. Up through the trees in the background may be seen the great rocks and moss-covered boulders and a storm-beaten old waterboom. On the right is the slope of the Aloe Knoll, with a trickling stream at its base, and at the head of the stream a group of tree ferns, bordered by a soft fern, *Hypolepis*. Beyond these, and making a wide semicircle round them, are a rooiels, an oudehout, a wild peach and, with the narrow path between, a rambling katdoorn. A little below and detached, as the "captain jewel of the carcanet" is the Camdeboo stinkwood (*Celtis rhamnifolia*), the only specimen known within our limits. It has been maltreated in the past, the trunk having been injured and the wide-spreading crown starved for want of light and deprived of space for expansion by the over-crowding oaks. As it is, the girth of the trunk is 10 feet 4 inches and its height 12 feet 4 inches. A good figure showing the monoecious unisexual flowers and the fruit is given in Dr. Marloth's "Flora of S. Africa," (Vol. I., Plate 23), and descriptive notes on page 133.

The last tree to notice is our only "laurel," the stinkwood (*Ocotea bullata*), near the lower end of the Skeleton Gorge path, but below its level and so easily overlooked. It is the largest specimen known in Kirstenbosch and one of the very few of any size that have survived. Dr. Marloth (l.c. Plate 62, pp. 229, 230) gives a picture of the flowers and fruit and some interesting notes on its distribution, and the *bullae* or bosses on the leaves.

THE ANNUAL REPORT OF THE BOTANICAL SOCIETY FOR THE YEAR 1916



T is satisfactory to be able to report that the position of the Society has been well maintained during the year under review, and that it has again been able to render material assistance to the National Botanic Gardens.

It is our painful duty to record the death of Dr. Pearson, Honorary Director of the National Botanic Gardens, Kirstenbosch, which took place on Friday, November 3rd, 1916. The late Dr. Pearson took a very active part in the working of the Society, and held a seat on the Executive since its foundation. The loss sustained by that body is one that has been very deeply felt by every member, and deep sympathy has gone out to Mrs. Pearson in her great bereavement.

At the Annual Meeting held on March 31st, 1916, the Right Hon. Sir James Rose-Innes, K.C.M.G., was elected President of the Society, and the following Vice-Presidents: Sir Lionel Phillips, Bart., Hon. Sir Lewis Michell, K.C.V.O., Hon. W. P. Schreiner, K.C., C.M.G.

The following were elected as the Executive for the year :—

W. Duncan Baxter, M.L.A.
Lady Rose-Innes.
Mrs. Carter.
Miss Fairbridge.
H. W. W. Pearson.
J. Storr Lister, I.S.O.
C. E. Pillans, I.S.O.
G. B. van Zyl, M.P.C.
M. Nash.
A. H. Reid.
H. T. Twentyman Jones.
F. Cartwright.

Under the auspices of the Society, Dr. E. P. Phillips delivered a very interesting address, illustrated by lantern slides, on " Proteas," in the City Hall, on October 24th, 1916, on the occasion of the Wild Flower Show. The lecture was well attended, and the thanks of the Society are due to him for this most instructive address.

A gathering of members was held at Kirstenbosch on Saturday, the 24th February, 1917, which was well attended. His Excellency the Governor-General did the Society the honour of being present. On this occasion Dr. Beattie delivered a short address on the life and work of Dr. Pearson.

Four meetings of the Executive have been held during the year.

The membership roll shows a slight decrease in number, owing to the fact that certain names were deleted as inactive, and in terms of the constitution.

The position in regard to numerical strength is as follows: 49 Life Members; 26 Family Members; 264 Ordinary Members; 45 Associates.

In view of the fact that the membership has decreased, the Executive ventures very earnestly to urge members to enlist the sympathy of all their friends, so that 1917 may at least restore the balance in both income and numbers, which could be more than done if each member would endeavour to obtain at least one recruit to the ranks of the Society.

FINANCE.

During the year the Society paid over to the Trustees of the Botanic Gardens the sum of £250 as a contribution to current expenses.

The development of Kirstenbosch has been continued during the year, and is steadily progressing in accordance with the plans of the late Director.

The amount at the credit of the Life Members' Fund is now £625. No grant from this fund has been made during the year.

JOURNAL.—Part II. of the Annual Journal of the Society was published during the year, and circulated to every member of the Society. Arrangements are being made to continue the publication during the coming year.

The thanks of the Society are due to the Press for their assistance in publishing, from time to time, lists of members and other matters pertaining to the work of the Society.

On behalf of the Executive,

W. DUNCAN BAXTER, Chairman.

FRANK CARTWRIGHT, Hon. Secretary.

Cape Town, March 12, 1917.

The Botanical Society of South Africa.

OBJECTS :

(*a*) To encourage the inhabitants of South Africa to take an active part in the progress and development of the National Botanic Gardens at Kirstenbosch, a part of the Groote Schuur Estate, in the Cape Province, and to induce them to appreciate their responsibility therein.

(*b*) To augment the Government grants towards developing, improving, and maintaining fully-equipped botanical gardens, laboratories, experimental gardens, etc., at Kirstenbosch.

(*c*) To organise shows at which may be displayed the results of botanical experiments or cultural skill in improving the different varieties of South African flora.

(*d*) To enlighten and instruct the members on botanical subjects by means of meetings, lectures, and conferences, and by the distribution of literature.

FOUNDED JUNE 10th, 1913

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THE RIGHT HON. SIR JAMES ROSE-INNES, K.C.M.G.

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Terms of Membership.

Life Members, subscribing not less than £25.

Family Members, subscribing not less than £2 2s. per annum.

Members, subscribing not less than £1 1s. per annum.

Associate Members, subscribing not less than 5s. per annum.

Associate Members enjoy all the privileges of Membership except that they do not vote at any of the Society's Meetings.

Honorary Members may be elected at a Meeting of the Society on the nomination of the Executive.

Sympathisers wishing to become members of the Society are invited to communicate with the Hon. Secretary, P.O. Box, 70, Cape Town.

THE COLLECTION OF SPECIMENS FOR KIRSTENBOSCH.

MEMBERS of the Society are invited to assist in stocking the Gardens with native plants. Specimens from all parts of Africa are desired. At present representatives of the following are particularly needed: *Aloes*, *Bulbs*, *Cycads*, *Ferns*, *Forest Trees* (seeds), *Protea* (seeds), *Heath* (branches bearing old flowers), *Euphorbia*, *Mesembrianthema*, *Cotyledon*, *Crassula* and *Stapelia* and medicinal and other economic plants.

From places within the Union consignments can be sent free by rail or post if addressed :—

BOTANICAL SPECIMENS. O.H.M.S.
To
THE DIRECTOR,
National Botanic Gardens,
Kirstenbosch,
Newlands, Cape.

INSTRUCTIONS FOR PACKING AND SENDING SPECIMENS

Cotyledons, *Crassulas*, *Euphorbias*, *Aloes*, *Stapelias*, *Mesembrianthema* and other plants of a like succulent nature, and also the *Epiphytic Orchids*, should be packed dry. Each species need only be wrapped in paper and laid tightly in a box. Large specimens of *Aloes*, *Euphorbias*, *Cycads*, etc., may be trucked loose.

Large specimens of Tree Ferns should be bound in wet grass or canvas, or with a little damp moss inside the canvas, and the stems should be strengthened with poles.

Ferns, Bulbous and Tuberous Plants in growth and flower need a little damp moss among the roots.

Distinct species of dormant bulbs and tubers, as well as of seeds, should be sent in separate wrappers.

Each consignment should bear (1) the name and address of the sender; (2) particulars of the locality in which the specimens have been gathered.

Common as well as rare species will be welcome. Fully addressed labels can be had on application.


THE ARGUS
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THE JOURNAL OF THE BOTANICAL SOCIETY OF SOUTH AFRICA

Part IV. 1918

Published under the authority of the Council of the Botanical Society

The Journal of the Botanical Society of South Africa.

PART IV. 1918

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THE SOUTH AFRICAN HEATHS.

THE South African heaths, in the same way as the proteas, early engaged the attention of European botanists, as specimens were brought back from the Cape by the early navigators. The first—or one of the first—reference to the group we have in botanical literature was in the year 1734, when a figure of one of the common heaths of the Cape Peninsula (*Erica Petiveri*) was published. At the end of the eighteenth and beginning of the nineteenth centuries the Cape heaths became fashionable in European gardens and were extensively cultivated. In 1764 the great naturalist, Linnæus, who first named the genus *Erica*, enumerated forty-two species, and the number of known species gradually increased until 1795, when 137 species of heath were recorded, though this figure was far short of the number of species in cultivation only nine years afterwards. A fine collection of living heaths existed at Kew in 1774, and this was constantly enriched by additions sent to England by Masson, His Majesty's collector at the Cape. A private gentleman, Mr. Geo. Hibbert, also had a large collection at Clapham garden, and employed a collector, Niven, whom he sent to South Africa on a collecting trip. A beautiful collection of Cape heaths was also got together at the Edinburgh Botanic Gardens, and was under the care of the Superintendent, Mr. Wm. McNab. The Duke of Bedford had a large collection of 394 species at his home, Woburn Abbey, some of which were grown in a specially erected heath house, but many of the more hardy species were cultivated in the open.

In 1793 the "Botanical Magazine" (a journal which still appears) published a coloured illustration of a heath, *Erica grandiflora*, and this is probably the first figure of a Cape heath published in colour. A few years later (1798) an illustrated monograph was published which dealt exclusively with the heaths, and in the years following several other authors published monographs on the genus, the principal of which were "A Catalogue of Heaths in the collection of the Duke of Bedford at Woburn Abbey" (1825); "The Heathery, or a Monograph of the genus Erica," published between the years 1804-09, which contains three hundred coloured illustrations; "Coloured Engravings of Heaths" in 1805, with 288 beautifully coloured plates; "A Treatise on the Propagation, Cultivation, and General Treatment of Cape Heaths," by Wm. McNab in 1832. In 1839 the genus was monographed by the celebrated English botanist, Bentham, who described 419 species from South Africa.

It is not surprising that among the specific names of a large and handsome group such as the heaths that we should find the names of famous botanists and collectors perpetuated. For example, we have *Erica Banksia*, named after Sir Joseph Banks, a former Director of the British Museum; *E. Hibbertia*, in compliment to the Geo. Hibbert mentioned above; *E. Massoni*, in honour of Francis Masson, who left England in 1772, on the recommendation of Sir Joseph Banks, as a collector for the Royal Gardens at Kew; *E. Nabea*, called after Wm. McNab, of the Royal Botanic Gardens, Edinburgh; *E. Sparrmanni* after Sparrmann, the famous South African explorer. Besides these few names of the older men, the names of the more recent South African botanists and collectors are associated with the heaths. We have, for example, *E. Guthriei*, after the late Prof. Guthrie, who worked with Dr. Bolus in revising the Cape heaths; *E. MacOwanii*, after the late Dr. P. MacOwan, a former Government Botanist, whose name will always be associated with South African botany; *E. Marlothii*, after Dr. R. Marloth, whose work on the South African flora is too well known to need mention; *E. Flanaganii*, after Mr. H. G. Flanagan, to whom we are indebted for our knowledge of the flora of Komgha especially; *E. Tysonii*, after Mr. Wm. Tyson, who has collected extensively in South Africa, and especially in East Griqualand. This list could be much enlarged, but the few examples above will suffice to show that the names of men intimately connected with the extension of our knowledge of the South African flora will never be forgotten.

The most recent work on the heaths is that by the late Dr. Bolus and Prof. Guthrie. It was published in 1905 and contains the names and descriptions of 469 species. Between the years 1839, when Bentham published his work, and 1905 a large number of new heaths was discovered by the recent collectors, who explored fresh areas, and this is shown by the fact that Dr. Bolus alone, or in conjunction with Prof. Guthrie, named and described 117 new species, or nearly 25 per cent. of the known species. In still more recent years some twenty additional species have been discovered and published, and there is every reason to believe that a considerable number is still to be found in South Africa.

Besides the genus *Erica*, we have in South Africa eighteen other genera, which, however, do not approach the heaths in the beauty of their flowers. With only three exceptions, all the genera of the *Ericaceæ* are endemic to South Africa, *i.e.*, they are not found outside the limits of the Union. We



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Details of the Structure of Heaths.

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EXPLANATION OF PLATE

PLATE I.

Fig. 1. Typical heath flower; *a*, calyx with pedicel and bracts; *b*, corolla; *c*, androecium and gynaeceum; *d*, stamen; *e*, gynaeceum; *f*, section of ovary.

,, 2. Types of leaves and leaf arrangement; *a*, opposite leaves; *b*, 3-nate; *c*, 4-nate; *d*, 6-nate leaves; *e*, *f*, open-backed leaves; *g*, typical ericoid leaf.

,, 3. Types of inflorescence; *a*, *d*, umbellate and 3-nate fls.; *b*, axillary fls.; *c*, terminal solitary fls.

,, 4. Types of corolla; *a*, tubular; *b*, vase; *c*, globe-tubed; *d*, bell; *e*, urn; *f*, cup; *g*, bowl.

,, 5. Types of anther; *a-f*, lateral; *g*, *h*, terminal; *a-d*, pore at apex of cell; *e*, *f*, pore in middle of cell; *a*, muticous; *b*, aristate; *c*, aristate-cristate; *d*, cristate.

,, 6. Types of gynaeceum; *a*, oblong glabrous ovary, simple stigma; *b*, ovate ovary, capitellate stigma; *c*, obovate villous ovary, capitate stigma; *d*, depressed-globose ovary, peltate stigma; *e*, stipitate cylindrical ovary, simple stigma.

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are not, however, concerned here with these minor genera, but only with the "true heaths."

The heaths are principally massed in the littoral strip running from the Oliphant's River as far eastwards as Grahamstown, beyond which they become rare. Their greatest concentration is on the Cape Peninsula, where such well-known species as *E. abietina* (large yellow "mealie heath"), *E. coccinea*, *E. viscaria*, *E. curviflora*, *E. mammosa* occur, as well as the rare *E. cyrilliflora* and *E. caterviflora*, while *E. Fairii*, *E. Urnaviridis*, *E. Halicacaba*, *E. gilva* and *E. conica* have not been recorded except from the Peninsula.

Many other centres, however, are noted for the more beautiful species, *e.g.*, Riversdale, where we find the white or pale pink "Albertinia heath" (*E. Bowieana*), the scarlet and green sticky heath (*E. blenna*), and the deep red or pale pink globular "Riversdale heath" (*E. ardens*). Elim is specially known as the home of the white and red "Elim heath" (*E. regia*), in the same way as French Hoek is for the waxy pink "French Hoek heath" (*E. ventricosa*), and Ceres for its yellow and red "petticoat heath" (*E. Thunbergii*), and its dark, dull red "cup-and-saucer heath" (*E. glauca*). The Caledon Division is so richly dowered with the finer kinds of heath that it is difficult to select a few examples. There are the "yellow-bell" (*E. campanulata*), "Bot River heath" (*E. Monsoniana*), "vlei heath" (*E. perspicua*), and the many beautiful vase-shaped heaths like *E. Irbyana*, *E. ampullacea*, *E. retorta*, and *E. aristata*. Montagu Pass has several fine species belonging to the group with long, tubular or trumpet-shaped flowers, *e.g.*, *E. densifolia*, *E. speciosa*, *E. dichrus*, and *E. glandulosa*, which latter, with *E. pectinifolia*, extends to the Van Stadens Mountains, near Port Elizabeth, while Grahamstown has the soft purplish-pink "Grahamstown heath" (*E. Chamissonis*).

On the Drakensbergen there exists quite an extensive heath flora, and all the species, with the exception of *Erica cerinthoides*, which extends from the Cape Peninsula into the mountains of Abyssinia, are unique on this high mountain range. Perhaps one of the most interesting contributions to the knowledge of the heath distribution in South Africa was made by the late Dr. Pearson during one of the Percy Sladen Memorial Expeditions, when he found three species of heaths growing on the Khamiesberg in South-West Africa. One of these species (*Erica dilatata*) had hitherto only been known from specimens in the Berlin Herbarium of what was probably a garden plant, and from a coloured drawing published in 1823.

The genus *Erica* shows a great divergence in its habit of growth and in the character of its vegetative and floral organs. Some grow into large shrubs, as *E. triflora* on the contour-path at Kirstenbosch, or even into small trees, as *E. caffra* in Platteklip Gorge; while others are slender scrambling shrubs, peeping from under the shade of a more sturdy growth, as *E. thymifolia* does, or, like *E. cyrilliflora*, jewelling the delicate soft verdure that often veils our mountain springs. On the top of Table Mountain, sheltered behind friendly ridges, others are found growing almost flat in the crevices of rock, like *E. petiolaris*, or, like the dainty *E. marifolia*, assuming the mat-like habit of the tufts of moss in whose soft cushions they seem to nestle. For the most part, however, they are medium or small shrubs, such as are found on the flats or exposed mountain sides, and have a strong hardy look, quite in keeping with the character of their surroundings and their time-honoured companions—the Proteaceae and Restiaceae. In the great majority of species the leaves are rolled back so that a narrow channel is formed on the under surface. Some few species, such as *E. thymifolia* and *E. hispidula* (Pl. 2, Figs. 8 and 18), have, however, flat or almost flat leaves (see Pl. 1, Fig. 2, *e* and *f*). The bulk of the species have whorled leaves, which are usually 3—4-nate, more rarely, as in *E. sessiliflora*, 6-nate, and, as in *E. purpurea*, 8-nate. In *E. brevicaulis*, *E. virginalis*, and a few other species, the leaves are opposite (Pl. 1, Fig. 2). The flower of a heath is made up of the following four structures (Pl. 1, Fig. 1):—

1. A Calyx.—The calyx consists of four *sepals* at the base of the flower (Fig. 1 *a*). The sepals are usually green and smaller than the corolla, but are sometimes coloured and occasionally larger than the corolla.

2. A Corolla.—The corolla is made up of four *petals* (Fig. 1 *b*), which in the heaths are not separated, as in the sweet pea, for example, but united to form a structure shaped like a tube, a vase, an urn, a bowl, a cup, or a bell. (Pl. 1, Fig. 4.) The colour varies from the purest white, through the most delicate blush of pink, to a deep crimson and a bright scarlet; from a pale cream, through shades of delicate green and greenish yellow to a rich orange; and finally these different tints are combined in varying degrees in the more handsome species that have now become so familiar to us all—such as the pink and green of *E. fascicularis*, the white and red of *E. regia*, and the scarlet and green of *E. blenna*. Only blue has Nature withheld from this wonderful range of colour.

3. An Androecium.—If we slit open the corolla, the eight stamens are exposed (Fig. 1 *c*). These are divided into two structures: (*a*) long, thin filaments and (*b*) small brown bodies at their apices, known as "anthers" (Fig. 1 *d*). The eight stamens, *i.e.*, eight filaments and eight anthers, together compose the androecium. It is in the anthers (Figs. 2 and 5) that the pollen grains are contained. The stamens may be hidden in the corolla or visible at its mouth or more rarely far exserted. The anthers are composed of two pollen-sacs variously united and usually have appendages of some sort at the base. These appendages, more especially in the wider-mouthed species, appear to block the passage to the honey, and the visiting insect would tend to touch them and thereby shake on to its own body the pollen out of the anthers. They open by two pores at the upper end, through which the ripe pollen escapes (Fig. 5).

4. A Gynaeceum.—The gynaeceum is the innermost structure (Fig. 1 *e*) and consists of a small globular body at the base, called the *ovary*; a stalk from the summit of the ovary, which must be short or long according to the size of the flower, this is the *style*, and at the apex of the style is the *stigma*, which may be only a slight swelling or may be expanded into a saucer-shaped structure (see Fig. 6). If the ovary be carefully cut across, four compartments (sometimes eight) called *loculi*, become visible (Fig. 1 *f*). In each *loculus* are numerous small white bodies, the *ovules*, which will eventually form the seeds (Fig. 2).

The flowers of the heaths are massed in several ways to form an *inflorescence* (Pl. 1, Fig. 3). In some cases the flowers are solitary and arise at the apices of short branchlets (Fig. 3 *c*). They may also arise singly in the axils of the leaves and then give the impression of a raceme (Fig. 3 *b*). In a great many species a group of flowers on short stalks is situated at the apex of a branch to form an *umbel* (Fig. 3, *a*, *d*), or the flower stalks may be so short that the inflorescences look like a *capitulum* or *head*.

Most species of *Erica* are visited by insects, which bring about pollination. Bees and flower-beetles carry the pollen from the ripe anthers on to the sigmas. Here the pollen grains germinate and send pollen-tubes down the style to the ovary. In these pollen-tubes is the male nucleus which eventually fuses with the female nucleus in the ovule, and thus brings about fertilisation. After fertilisation, the ovules grow and become seeds, while at the same time the ovary changes into a fruit. In some species of *Erica* with long tubes, pollination is effected by birds. The seeds of the heath are generally very minute and are distributed by the wind.

The heaths may be divided into five fairly well defined groups on the relative proportion of the calyx and corolla and on the shape of the corolla. In the first group (Fig. 7A.) the calyx is small and the corolla conspicuous. This is again sub-divided into the following three sub-genera :—

1. Syringodea, in which the corolla is tubular and rarely less than half an inch long (Fig. 7, A.1).

2. Stellanthe, in which the corolla is either tubular or vase-shaped, but the four lobes are flat and star-shaped (Fig. 7, A.2).

3. Euerica, in which the corolla is small, rarely over one-third of an inch long and is urn-shaped, bell-cup-, or bowl-shaped (Fig. 7, A.3).

In the second group the calyx is large and in many cases more conspicuous than the corolla (Fig. 7, B). This group is sub-divided into two sub-genera.

4. Chlamydanthe, in which the mouth of the corolla is scarcely, or not at all, widened (Fig. 7, B.1).

5. Platystoma, in which the mouth of the corolla is distinctly widened (Fig. 7, B.2).

Each of the above sub-genera is divided into sections, of which there are altogether forty-one. It would be going into too much detail to give the characters of these sections, and would be outside the scope of a paper such as this.

In France the rootstock of the common heath in the South, known as " bruyere " is used for making " briar " pipes, and in ancient times the Greeks considered their heath had medicinal properties. (They called it " the breaker "—" ereike "—because it was said to break stone in the bladder. This name was adopted by Linnæus for the genus and the etymology clearly indicates the pronunciation of the word—the " i " being long and not short, as is usually supposed.) Up to the present our heaths have had no real economic value in their own land, except as a means for providing honey. In Europe for a century and a half they have been cultivated and sold. Would it be too much to hope that in the near future we shall hear of flourishing heath-farms in our midst, where cut flowers are sent to the markets already created for them in Cape Town and Johannesburg; where bees may revel among those flowers which would be kept for the seed, now being asked for in all the botanic gardens of the world; and where pots of heath may be produced to be sold in our shops? In this way the labour of the flower sellers in Adderley Street, now a serious menace because of the unscrupulous and ignorant manner in which the picking is done, would be directed into safe and more profitable channels, and the heathlands of South Africa, now being burnt out, would be preserved to our children's children for all time.

For we must not forget that man cannot live by bread alone; nor will our children work for bread alone, as their fathers were forced to do before them, when they won this portion of the earth and the fruits thereof for the heritage of the young South Africans. Their joy in the beautiful things of their native land is visibly increasing because they are being taught to understand them, and, when we consider what has been accomplished in the few short years of the existence of Kirstenbosch, this dream of the preservation of our heath-flora seems on the very verge of being realised. It is surely no far cry from the training-ground of Kirstenbosch to a heath-farm in the Caledon Division; and to those of us who remember the words of the greatest Teacher the world has known, how that faith can remove mountains, this cry becomes less far and more audible each day.

E. Percy Phillips and L. Bolus.



M. M. Page del.

Sprigs of the Native Heaths of Kirstenbosch.

4. A GYNAECEUM.—The gynaeceum is the innermost structure (Fig. 1 *e*) and consists of a small globular body at the base, called the *ovary;* a stalk from the summit of the ovary, which must be short or long according to the size of the flower, this is the *style*, and at the apex of the style is the *stigma*, which may be only a slight swelling or may be expanded into a saucer-shaped structure (see Fig. 6). If the ovary be carefully cut across, four compartments (sometimes eight) called *loculi*, become visible (Fig. 1 *f*). In each *loculus* are numerous small white bodies, the *ovules*, which will eventually form the seeds (Fig. 2).

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EXPLANATION OF PLATE

PLATE II.

Fig. 1. Erica cerinthoides, L.; 2, E. curviflora, L.; 3, E. coccinea, Berg.; 4, E. hirtiflora, Curt.; 5, E. Plukenetii, L.; 5*a*, pedicel, with calyx and bracts; 6, E. Petiveri, L.; 7, E. nudiflora, L.; 8, E. thymifolia, Wendl.; 9, E. pubescens, L.; 10, E. imbricata, L.; 11, E. mammosa, L.; 12, E. baccans, L.; 12*a*, corolla of do.; 13, E. triflora, L.; 14, E. purpurea, Andr.; 15, E. calycina, L.; 16, E. conica, Lodd.; 17, E. viridipurpurea, L.; 18, E. hispidula, L.; 19, E. transparens, Berg.; 20, E. lutea, Berg.

PLATE II.



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Sprigs of the Native Heaths of Kirstenbosch.

A NOTE ON THE NATIVE AND CULTIVATED HEATHS OF KIRSTENBOSCH.

THERE are approximately twenty species of native heaths at Kirstenbosch. Of these the commonest is *E. hirtiflora*, which grows in such masses as to purple the lower slopes between the trolley track and the Skeleton Ravine. Frequent also on the slopes, but never growing socially like *E. hirtiflora*, are *E. nudicaulis, E. coccinea, E. conica, E. purpurea, E. Plukenetii, E. hispidula, E. mammosa* and *E. triflora*. Much less frequent on the slopes are *E. transparens, E. calycina* and *E. lutea*. Trailing in damp or shady places is the delicate *E. thymifolia*, while the tall *E. curviflora* is usually found near streams or in swampy places. *E. baccans* is conspicuous on the Aloe Kopje in July and August.

The following key, together with the illustrations on Pl. 2, will enable students to identify the native heaths of Kirstenbosch :—

Corolla hairy.
- Corolla tubular.
 - Flowers more than 3 in a cluster — *cerinthoides*, L.
 - Flowers 1—3 in a cluster.
 - Leaves 6-nate ; fls. on the main branch. — *coccinea*, Berg.
 - Leaves 4-nate ; fls. at the end of short branchlets. — *curviflora*, L.
- Corolla urn-shaped or cup-shaped.
 - Fls. 4-nate, corolla coarsely hairy — *hirtiflora*, Curt.
 - Fls. 3-nate, corolla velvety — *pubescens*, L.

Corolla glabrous.
- Anthers exserted.
 - Corolla more than ¼in. long.
 - Bracts remote — *Plukenetii*, L.
 - Bracts approximate. — *Petiveri*, L.
 - Corolla less than ¼in. long.
 - Sepals less than half as long as reddish corolla.
 - Leaves open-backed. — *thymifolia*, Wendl.
 - Leaves not open-backed. — *nudiflora*, L.
 - Sepals about as long as white corolla. — *imbricata*, L.
- Anthers included.
 - Corolla with 4 depressions at the base.
 - Corolla tubular. — *mammosa*, L.
 - Corolla globosely urn-shaped. — *baccans*, L.
 - Corolla not having 4 depressions.
 - Sepals about as long as corolla-tube.
 - Corolla-segments shorter than corolla-tube. — *triflora*, L.
 - Corolla-segments equalling or longer than corolla-tube — *calycina*, L.
 - Sepals much shorter than corolla-tube.
 - Corolla ¼in. or more long.
 - Sepals hairy. — *coccinea*, Berg.
 - Sepals glabrous.
 - Corolla up to 1in. long — *purpurea*, Andr.
 - Corolla up to ½in. long — *conica*, Lodd.
 - Corolla less than ¼in. long.
 - Corolla bowl-shaped.
 - Stigma capitellate. — *viridipurpurea*, L.
 - Stigma peltate. — *hispidula*, L.
 - Corolla not bowl-shaped.
 - Corolla pale pink — *transparens*, Berg.
 - Corolla yellow — *lutea*, Berg.

Among the heaths in cultivation at Kirstenbosch the following have flowered during the year: *E. sessiliflora, Thunbergii, pinea, glomiflora, nobilis, globosa, Plukenetii, vestita, nematophylla, perspicua, tenuifolia, coccinea, nudiflora, hirtiflora, lanata, hebecalyx, densifolia, glandulosa, ramentacea, cerinthoides*, and *seriphiifolia*.

There is no reason, given the necessary labour, why heaths should not be cultivated extensively at Kirstenbosch. They are being grown there now chiefly from seed. In this connection it is interesting to note that Miss Rayner, in her recent investigations on the European "white heather" (*Calluna vulgaris*) discovers that not only is the mycorhizal fungus on the roots alone, but that all the tissues of the plant are infected with it, even the ovary and seed. It might be assumed from this that young plants raised from seed are already provided with the necessary fungus and that no specially prepared soil is needed.

L. BOLUS.

SOME VIEW-POINTS AT KIRSTENBOSCH.

AMONG the attractions of our National Botanic Gardens at Kirstenbosch by no means the least is the beauty of the situation, and the object of this paper is to draw attention to certain spots in the Gardens from which especially striking views, typical of a considerable variety of scenery, may be obtained.

After entering the Gardens at the main gateway, at the bottom of the new deviation in Rhodes' Road, let us proceed some fifty yards along the drive, and just beyond an avenue of oaks which leads away to the right, pause for our first " view-point " by the corner of the open grassy lawn.

I. This is a good point from which to gain some idea of the " setting " of the Gardens—and a magnificent view it is which bursts suddenly upon us. Beyond the undulating greensward, and the oaks clustered behind it, the grand grey cliffs of Table Mountain tower up over three thousand feet into the air. Surely few, if any, National Botanic Gardens can boast of such a background! Below the cliffs, dark wooded slopes, clad with a variety of native trees, stretch from north of the Window Gorge to the Skeleton Ravine. Notice how these trees love to nestle up the kloofs, and how well their rounded tops harmonise with the rounded rocks; for, in spite of all their ruggedness, the sandstone cliffs are weathered into rounded forms.

Southwards the mountain is lower and less precipitous. The slopes are clad chiefly with shrubs and grass, which veil, without destroying, the natural beauty of their modelling. Here and there bits of grey rock jut out, tinted with lilac and orange; between them are soft green contours. Green, yes, but not a flat crude green. The higher parts, especially above Skeleton Ravine, are a bronzy green, soft and velvety looking in the distance, brightened sometimes with golden patches of *Leucadendron salignum*. The lower slopes are of more varied tint, with grey waaboom (*Protea grandiflora*) and bush and shrubs of many shades from silvery grey to dark evergreen, while mingled with these at certain times of year are tracts of purple heather.

The variety of " broken colour " delights the eye of an artist; and the rocks and swelling contours give a feeling of vigour and life to the mountain, just as the indications of bones and muscles give vitality to a statue. The botanist knows and appreciates the wealth and variety of the flora at the different altitudes, while to those who have had the privilege of climbing the mountain, the sight brings reminiscences of pleasant excursions, of the aromatic scents of the bush, and the delicious air and spacious views of those higher regions.

Now let us continue our course along the drive, pausing a few moments a little higher up, where the Devil's Peak comes into sight, and where a pond in the grass, with its dark reflections, adds a new feature to the scene. Ahead of us, as we proceed on our way, trees nestle up the Nursery Gorge, and near its summit sits a big mass of rock like a huge mediæval castle—the " Pulpit Rock," or " Castle Rock," as it is sometimes called. At the entrance to the Fern Gell we pass through some posts a little to the left, and a few yards further on come to our second " view-point " by the Marsilia Pool.

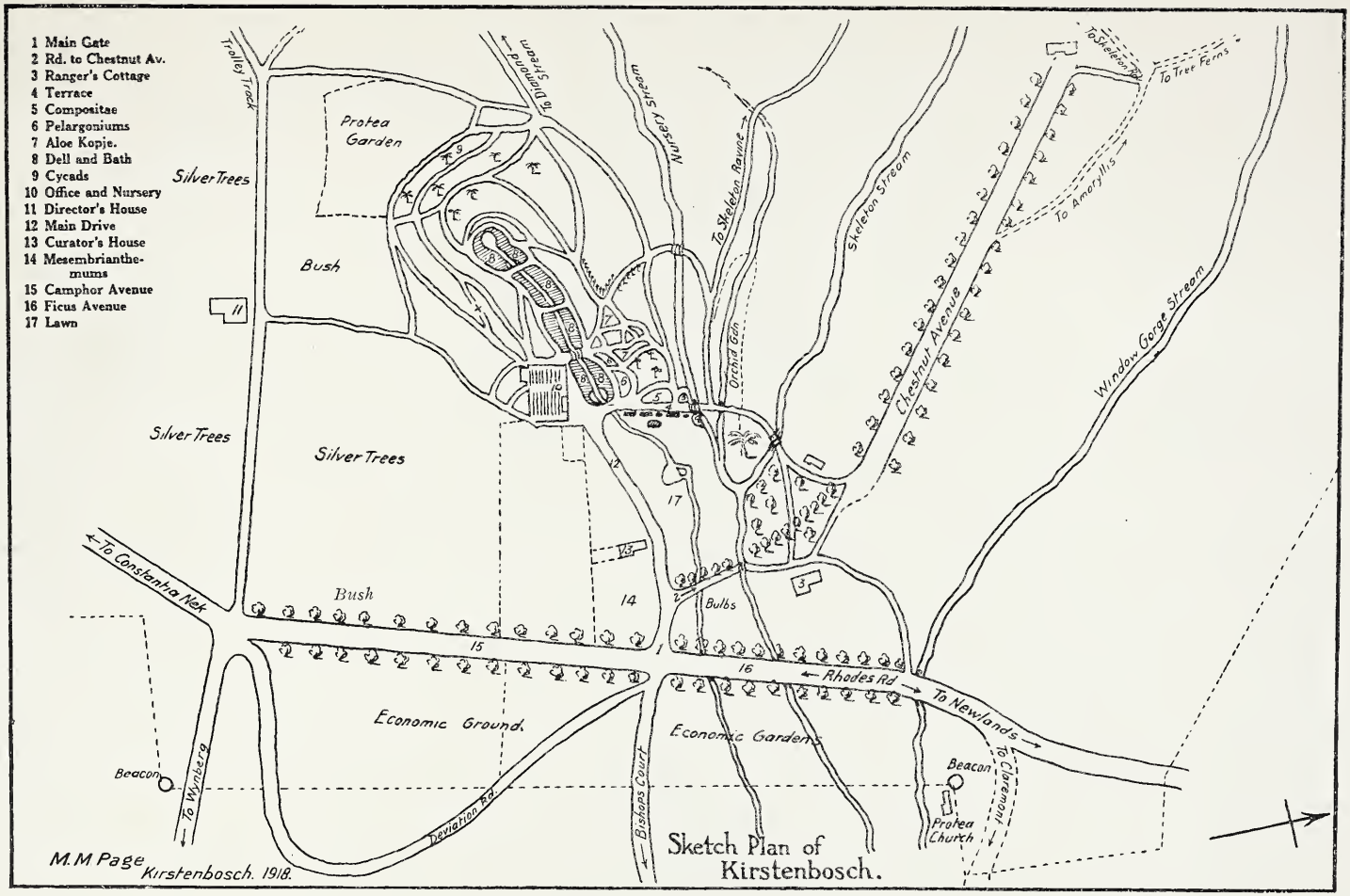
II. Here there is no extensive view, but a gap in the trees gives a charming peep of the great buttresses of Table Mountain and the Peak. At our feet lies the clear pool, dotted with water-plants and surrounded by beautiful tree-ferns and shrubs. Beyond it a graceful silvery *Virgilia capensis* (or keurboom), namesake of the poet Virgil, stands out against the blue shadows of the mountain, its feathered foliage contrasting well with the dark glossy green of the turkeyberry (*Plectronia ventosa*) on the right; while in pleasant harmony with the scene is the cheerful sound of running water.

Going a little further up the Fern Dell we find on our right a rustic bridge. By looking over the rails on either side we may get a good general idea of the pretty little dell, with its rippling stream and miniature cascades, its ferns and flowers.

Crossing the bridge, we take a curved path which passes between a clump of feathery virgilia and a low-spreading *Brabeium stellatifolium* (wilde amandel), and leads to the Aloe Kopje. Directly opposite is a narrow paved path, along which our way lies.

If it is winter we may follow this path to the other side of the Aloe Kopje, and turn a few yards down hill to the right. Here we shall find a cluster of our Peninsula aloe, *A. succotrina*, planted among picturesque lichen-spotted rocks, with its tall red flower-spikes magnificently set off by a background of native bush and the dark wooded slopes north of the Skeleton Ravine.

In winter or spring it is worth while making another little détour, further down this path, to the rustic bridge at the northern end of the broad terrace walk above the lawn. Here we have a wild stream, a contrast to the Fern Dell, but not less beautiful in its own way. The brown and golden water, sparkling in the sunlight, comes rushing down through the bush and grass and among many-tinted stones. But in summer this stream is probably dry, the stones in its bed look white and bare, and *Aloe succotrina* is not in flower.


1 Main Gate
2 Rd. to Chestnut Av.
3 Ranger's Cottage
4 Terrace
5 Compositae
6 Pelargoniums
7 Aloe Kopje.
8 Dell and Bath
9 Cycads
10 Office and Nursery
11 Director's House
12 Main Drive
13 Curator's House
14 Mesembrianthemums
15 Camphor Avenue
16 Ficus Avenue
17 Lawn
Trolley Track
To Diamond Stream
Protea Garden
Silver Trees
Bush
Nursery Stream
To Skeleton Ravine
Orchid Glen
Skeleton Stream
To Skeleton Ravine
To Tree Ferns
To Amaryllis
Chestnut Avenue
Window Gorge Stream
Silver Trees
Silver Trees
Bush
Bulbs
To Constantia Nek
Rhodes Rd
To Newlands
Economic Ground.
Economic Gardens
Beacon
To Wynberg
Deviation Rd.
Bishops Court
Beacon
Protea Church
To Observatory
Sketch Plan of Kirstenbosch.
M.M Page Kirstenbosch. 1918.

In summer, then, we will take the first turn up hill to the left out of the paved path, just beyond a two-forked *Aloe Bainesii*, and make our way towards our third "view-point," near a solitary sentinel pine at the top of the aloe garden. A little above the tree we enter a new broad path between double rows of short aloes—*A. ferox*.

III. Our first "view-point" showed us the "*setting*" of the Gardens; this is an excellent spot from which to obtain its "*outlook*"—and a beautiful and extensive outlook it is.

The great dark pine, a little below on our right, sets off the delicate tints of the distance as a dark frame sets off a picture. Beneath us we see the green lawn and the little blue pond. At our feet, slightly to the left, are the grey rocks and succulent vegetation of the Aloe Kopje, often brightened with red or orange spikes of flower; and beyond them a line of oaks slant down with graceful, irregular curve. On the right is the Wynberg Hill; the upper part has been sadly marred by a recent bush fire, but lower down the pine-clad slopes, giving symmetry in form and contrast in colour, sweep down to the Bishopscourt woods. Through the broad V of this valley the distance melts gradually away, over the flats, streaked with dark lines of trees and dotted here and there with little red and white houses, to a long row of hills and mountains, pale lilac and blue.

Conspicuous in the centre is Simonsberg, with four peaks against the sky and a lower one on either side. Beyond it, and to the right, are the perpendicular cliffs of the Drakenstein mountains, the twin peaks of Jonker's Hoek; the Stellenbosch range and Guardian Peak, extending southwards to Helderberg; and the Hottentots' Holland mountains, with the Somerset West Triplets, Somerset West Sneeuwkop and Sugar-loaf.

To the left of Simonsberg lies Klapmuts, and a lower hill where two little rounded points show the granite rocks of Paarl, and above them range upon range of mountains stretch away to the north. Among the peaks that show against the skyline are Du Toit's Peak, in winter usually capped with snow, Witteberg and Slanghoek Peak, Upper and Lower Wellington Sneeuwkop, and on a clear day the Waaihoek Range and Mostert's Hoek Twin Peaks over sixty miles away.

Above and behind us tower the cliffs of Table Mountain and the Castle Rock by Nursery Gorge. On our left, at the end of the aloe-bordered path, is a thick clump of *Brabeium stellatifolium*, part of the hedge of "wild almond" planted in the days of Van Riebeek to keep off plundering Hottentots. It would not be easy to drive cattle through a hedge of such dimensions!

We now turn to the right and follow a line of taller aloes, standing in a row like soldiers at drill. Just after passing a clump of bee-haunted virgilia, the ground below them strewn with their pale blossoms, we find a path that turns sharply up hill to the right under some oak trees, and leads to the proteas. From this path we look down on the two tall Cape hollies (*Ilex capensis*) by the Bath in the Fern Dell, and on the Cycad Amphitheatre. Just beyond two graceful little virgilias we take a path to the left, going below the proteas and above the cycads. Over the latter we get picturesque glimpses of the Fern Dell and the distant flats, while if we look back once or twice, the great cliffs of Table Mountain soar into the sky far above us, showing their height to full advantage. A track turning down on the left must be avoided, and at the further end of the Protea Garden our path passes through some young trees and joins another track. We turn along this to the right, up hill, and pause in the Silver Tree Forest near a picturesque little group of six or seven young silver trees for the fourth "view-point."

IV. The special feature of this view is the grand profile of Table Mountain itself. It is a magnificent sweep of line from the great cliffs and buttresses, over wooded foot-hills, and right away to the flats. When the air is clear one may catch a glimpse of the Great and Little Winterhoek, eighty miles off, beyond the Tygerberg. The silver trees to the right hide parts of the less distant ranges, and add a new feature to the scenery. We are closer to the bush in the Nursery Gorge and on the adjacent slopes, and can see more of its wealth and variety of detail. The Castle Rock is just above us, and by some effect of foreshortening makes us imagine, quite mistakenly, that we could reach it by a short and easy climb.

The next "view-point" is not far away. Proceeding up the path for a few yards beyond the seven sister silver trees, we meet another track, and turn abruptly to the left towards the top of the Silver Tree Ridge. At the junction of this track with a path coming down from the mountain beside a line of telephone posts and wires, stands a tall silver tree, and under its shadow we may find our fifth "view-point."

V. For years, we might almost say for centuries, silver trees have been the pride and glory of the Cape Peninsula; and it is silver trees that form the dominant characteristic of this view.

They are kindly trees; they do not destroy the undergrowth, but only shelter it from the sun's hottest rays; and the bush in return gives protection to seedling trees. There is variety of colour and form in this undergrowth, bushes of bright or dark green, glossy or feathery, and the trees contrast well with it. Their botanical name, *Leucadendron argenteum* ("shining-white tree, silvery") suggests the qualities described by the English and Dutch names—"silver tree" or "witteboom." How wonderfully do the trees harmonise with the scenery! The young trees have the leaves set close on the branches, and seem like great silver torches or candelabra. On the older trees the leaves grow in smaller tufts; they do not blot out the distant view, but only veil it, and as we look through or over them at the wooded slopes, the flats and far-away mountains, they dance in the breeze and the sunshine, and there is a shimmer like mother-of-pearl. Silver trees do not mind the south-easter; it caresses them, and they play with it. Should clouds be resting on the mountain, we watch for a blast to bend the tops of the trees and make them show out, shining white

against the sombre background. The sheen and the sharp contrasts between light and dark on the boughs are like polished metal.

Beyond the flats, Simonsberg is again a central feature in the view, other mountains melting away into the distance. To the right, silver trees raise graceful forms against the sky, and yet further to the right, over the summit of the hill, we may catch a glimpse of the massive Kogelberg, above False Bay. The path by the telephone wires leads us along Silver Tree Ridge to the upper gate of the Gardens, at the top of the deviation in Rhodes' Road.

But this account of Kirstenbosch would be incomplete without the mention of one other "view-point." It is a point that was specially selected by the first Director of the Gardens himself, the late Dr. Pearson, namely, the stoep of the Director's house.

The house stands on Silver Tree Ridge, at an altitude of five hundred feet above the sea, and thus it enjoys the combined attractions of a silver tree view and an outlook. Part of the charm consists in the grouping of the trees, and in the delicacy and variety of curving lines of hill and mountains, contrasted with the horizontal streaks of white sand or dark bush on the flats. The silver trees beyond the fence of the private garden relieve what might be monotony in the sky-line without hiding too much of the distance.

In our view from the Aloe Kopje, the converging lines of the broad V helped to bring the picture together into one whole. Here we have a reverse effect, and the ridge of hill falling away to either side divides the scene naturally into three parts—though without making any hard-and-fast line between the parts, or interfering with the beauty of the whole.

In the centre, set off by groups of silver trees on either side, we have a charming peep of distant flats and the blue Sugar-loaf mountain over the saddle-back curve of Wynberg Hill. To the left, as the hill dips down, we look over a foreground of silver tree forest and native bush to the woods of Bishopscourt and Newlands, the flats with their ever-changing colours and the distant mountains. While on the other side, beyond the gay flowers of the Director's garden, a fine grove of silver trees dips down towards the right, and reveals the vineyards and cultivated fields of Constantia and Retreat, the Muizenberg range, the flats and vlei of Lakeside, and a strip of blue sea edged with white sand-hills. This last view is particularly beautiful on days when there are clouds about, and the cloud shadows chasing each other over the flats cause the effects of light and shade to alter with bewildering rapidity.

* * * * * *

All scenery varies with changes of weather and of seasons, and it often happens that a view which enchants us on one occasion appears comparatively tame and uninteresting on another. The views here selected form no exception to this rule; though perhaps only an artist realises how much the colouring alters in response to sunshine or to cloud.

Let me, in conclusion, mention two or three of the rarer and more transiently beautiful effects that I have noticed from Silver Tree Ridge.

One day there was a south-east haze over the flats, making the distant mountains dim and ethereal. The sky was cloudless, and the silver trees danced in the breeze. The whole scene was a fascinating shimmer of pale blue and silver. Once before, years ago, I remember seeing a similar colour effect in Italy, among olive trees near the shores of Lake Trasimene.

Then there was a moon-rise, seen through a glade in the silver tree forest. On either side silver trees shaded with bluish-green stood dark against the sky. The tops of others, lower down the hill, showed silvery against the great mountain shadow that was stealing slowly over the flats. The flats, golden and pink in the light of approaching sunset, melted away into a dim purple distance, where peaks and ranges were indistinguishably mingled with a great bank of clouds, whose bright rounded tops were suffused with rosy light. Above all a pale nearly full moon mounted gently into the clear sky.

Another day, quite early, the newly risen sun was shining down over a thin low mist that covered the flats and turned them into a silvery sea. There were even little sprays of mist to counterfeit the foam of the breakers. The whole landscape was filled with the freshness and brightness of morning.

Kirstenbosch appeals to lovers of Nature in many ways. It is intended to be not only a great National Botanic Garden, but also a refuge for the wild plant and bird life of the Cape Peninsula, and a unique sanctuary of South African natural beauty for the world.

F. M. White.

THE ALOES OF KIRSTENBOSCH.

THERE are probably more than fifty species of aloe now growing at Kirstenbosch, of which forty-six have been specifically named. With two exceptions all these are to be found in the Lily Garden, or, as it is usually called, the Aloe Kopje, because of the predominance of this genus, which is surely the queen of the South African Liliaceae.

It would seem, from what there is at present before us, that the soil, although somewhat sandy, is well suited to aloes; and the climate with its long dry summer (which enables these plants to use up a great deal of their stored-up moisture and thereby to be in a much better position to cope with the rainy winter) makes it possible to cultivate a large number of species with very satisfactory results.

In choosing sites for the various aloes that are sent in to the National Botanic Gardens attention is paid to two points: (1) to keep them together, as far as is possible without detriment to the general effect, in botanical groups; and (2) to arrange them to look as if growing in their native haunts.

As examples of the first may be given the Leptoaloe (or slender aloe) Group—comprising *A. Cooperi*, *A. Ecklonis*, *A. micracantha*, *A. Boylei*, etc., planted at the base of the Kopje, facing the Dell, on the left-hand side, and the Pachydendron (or thick tree) Group, on the right-hand side, comprising *A. ferox*, *A. Marlothii*, *A. africana*, etc.; while a good instance of the second principle may be found in the grouping of the Kirstenbosch aloe, *A. succotrina*. Half way up the Kopje, and where the Nursery Gorge stream bubbles down its rocky channel—among its own grey sandstone rocks, and with its own Table Mountain vegetation as a background—this group forms one of the most delightful bits of planting in the Gardens. As a contrast may be noted the planting of *A. rubrolutea* on the lower eastern slopes of the kopje—the older plants spread out irregularly behind the shorter younger ones, and the intervening ground dotted with various low-growing bulbous plants collected, with these aloes, by Dr. Pearson in South-West Africa. Yet another contrast is the planting of *A. Kraussii* in a swampy place along the banks of a rivulet on the lawn, where at present it looks as much at home as by its own streams in Natal.

From the gardener's point of view, the habitat of a plant *has* to be considered for the sake of its health. It would therefore be a great help if contributors would state briefly the natural habitat of the plants which they send to the Gardens. For instance, *A. saponaria* evidently prefers shade to sun, and in its natural state probably grows under the shade of bushes or trees. It has had to be moved from the Aloe Kopje to a shadier spot, and only there will it thrive.

Most aloes may be easily grown from seed—a very slow method. A considerable number (*A. latifolia*, *A. saponaria*, *A. Dyeri*, *A. lineata*, etc.) send up suckers from the base of the plant. These may be left if it is desired to produce a clump—or each sucker, if cut off and planted, will grow into a normal plant. Branching aloes (*e.g.*, *A. plicatilis*, *A. arborescens*, *A. Bainesii*, *A. ciliaris*, etc.) may be propagated by cuttings.

For the most part aloes need little attention after they have been planted, except for a clearing away of the old leaves when they give the plant an untidy appearance. In the case of the so-called stemless species it is impossible to prevent the soil from getting between the leaves. If it is allowed to lodge there it will hold water and cause the plant to rot. This is fatal, for, as the heart of the plant rots first, nothing can be done for it.

Stemmed aloes, like *A. Bainesii*, *A. Marlothii*, *A. africana*, etc., usually rot from the root upwards. If the rotted parts of the stem be cut off, the clean stem may be planted, when it will root.

Hardy as aloes are, however, they are subject to several diseases and pests, with difficult names enough, but quite easy to recognise on one's plants.

The worst of these is a fungus disease, which seems especially to attack *A. striata*. It is specially bad during the winter, and shows itself on the leaves in round orange patches, each one containing a series of brown circles, which crack and free the dark brown spores. So far the best way to treat it has been to cut off the affected leaves as far as possible and spray with Bordeaux Mixture or Resin Wash.

Among the pests are a small white "scale" which covers the tips or more of some of the leaves, and a brown "scale." Spraying with Resin Wash has so far been effective in keeping both within bounds.

Just recently a third pest has made itself troublesome, especially on *A. arborescens*. The growing tip and young leaves of an aloe will turn yellow, while often a dark mass appears in their centre. If this whole part is cut off, the pith of the stem will disclose a large, soft, white grub, neatly curled and filling up its centre, or a mass of small ones surrounded by slime. After removing these, the stem should, as far as possible, be cut clean.

The genus aloe is by far the largest of the S.A. *Liliaciae*, and is widely distributed over the Union. From the Western Province are established at Kirstenbosch, *A. plicatilis*, *A. haemanthifolia*, *A. stans*, *A. distans* and *A. mitriformis*, together with

A. succotrina, *A. commixta* and *A. saponaria*, originating from the Cape Peninsula itself; while from the Eastern Province have been sent *A. ciliaris*, *A. africana*, *A. Ecklonis*, *A. longistyla*, *A. speciosa* and *A. humilis*; from the Karroo *A. variegata* (Kanidood), *A. striata* and *A. microstigma*; from Natal *A. Boylei*, *A. Bainesii*, *A. Greenii* and *A. ferox*; from the Transvaal, *A. Dyeri*, *A. Marlothii*, *A. transvaalensis* and *A. Davyana*; and from South-West Africa, *A. dichotoma* (Kokerboom), *A. rubrolutea*, *A. Schlechteri* and *A. hereroensis*.

Coming from such varied sources the aloes in the Gardens flower at different times of the year—so that at least two or three species are in flower each month of the twelve.

During the hottest summer months the Leptoaloe Group, mentioned above, is at its gayest, while during February the brilliant note of colour is struck by *A. latifolia* and *A. stans*. In February, too, we have *A. hereroensis*, with its greyish leaves and beautiful and branching yellowish-red inflorescence.

Through March and April the tall *A. rubro-lutea* throws up its candelabra of red spikes, and the pale pink *A. Davyana* belonging to the spotted-leaved group, keeps it company.

During the winter months the largest number of aloes is in flower. May sees the Cape Peninsula aloe *A. succotrina* with its dark red spikes, *A. pluridens* and *A. pretoriensis* (Pretoria) in flower—as well as *A. arborescens*, the handsome bushy aloe with short red spikes from Mossel Bay, and the tall *A. Bainesii*.

In June and July quite a blaze of colour is made by the red and yellow spikes of *A. microstigma*, the straight, yellowish red spike of *A. africana* and the curious flat spreading yellow inflorescence of the large *A. Marlothii*.

August finds the rare French Hoek distichous-leaved *A. haemanthifolia*, with its spike of red flowers out, and also the curious *A. longistyla*, the top of whose red spikes looks too heavy for its short stem and shorter white-spotted prickly grey leaves.

A. plicatilis, with its clump of fan-shaped clusters of leaves, puts forth its beautiful large (for an aloe) deep red bells during September, while *A. variegata* (Kanidood) flowers at the same time.

October finds *A. ferox* out, its spikes of dull, yellowish red flowers, with their long exserted brown stamens, giving the plant rather a shabby appearance—while in contrast *A. striata*, with its grey-striped leaves, puts forth its large, showy, red inflorescence. (Most S.A. rockeries show one or more plants of *A. striata*.)

A. aristata, with its small, thin, very prickly, closely packed leaves, sends up its short red spikes in November—and to end the year's rotation, in December are *A. stans* and *A. distans*, with the red flowers of their branched inflorescences crowded up to the top of the stem and there curiously flattened out—and *A. Broomii* (Hope Town), whose flower spike has rather the same shabby appearance as *A. ferox*.

Many aloes, unmentioned here, also flower during the year, so that the Aloe Kopje always has some corner looking bright.

Few of the aloes have any economic value. *A. ferox* yields the well-known aloe drug (alwi, or bitter aloes). The bitter sap is used for dressing wounds. The drug is prepared by cutting the leaves of the aloe in August and September, and arranging them in a circular pile with the cut portions inwards, which drip the sap into a goat-skin placed in a hollow in the ground in the middle of the pile. The sap is then dried. *A. africana* possesses the same qualities as *A. ferox*, but is not used, as its leaves are smooth, and, unlike *A. ferox*, whose leaves are very spiny, cannot grip and keep the pile together.

A. plicatilis also yields the drug but in a milder form, while *A. arborescens* is also used.

N. HARVEY.

OBSERVATIONS ON "BUCHU" AT KIRSTENBOSCH.

OWING to the increasing interest in the cultivation of Buchu as a commercial proposition it was decided to establish cultures and trials in the Economic Grounds for the study of its requirements and the methods of harvesting.

Accordingly, during 1914, with the assistance of the Department of Forestry, a quantity of seed was procured. Four sites were selected, about eighty yards in length and seven feet wide, on the northern slope of Wynberg Hill.

No. 1, at the base of the slope, consisted mainly of a black sandy alluvial soil, which was occasionally flooded in winter. On this site a few seeds only germinated at the driest end, and these did not survive the winter.

No. 2, at about twenty yards higher up the slope, was on a reddish sandy loam. This site was drier and somewhat enclosed with trees and hedges on all sides. Germination was fair for buchu, as also was the subsequent growth. They, however, only bore a few flowers during 1917.

No. 3, about eighty yards further up the slope, was in an open position. The soil was a red gritty loam—rich in iron, and deficient in lime for ordinary cultures. The subsoil was "dry," and composed of clay with a large quantity of quartz grit, with here and there a seam of ironstone gravel. The germination was about the same as on No. 2, but the subsequent growth has been greater; the plants being now about double the size. During 1917 the plants flowered freely, and several ounces of seed were gathered.

The above sites were trenched two spades deep, but no manure or fertilisers used at any time; and the seeds were sown by hand *in situ* during April.

No. 4 was selected on an open space among Silver Trees, a little higher up but with the same northern aspect. The surface soil has an accumulation of humus, but the body is as for No. 3. This site was prepared only by grubbing out the scrub, and the seeds were broadcasted over it in July. The germination was bad, but the first year's growth was equal to the best average on the other sites. Later, these plants were grazed to the crown by buck, as it was thought at the time. During 1917, however, the spoor of buck was clearly traced from tree to tree in a line of Carob Trees among the buchu on No. 3, and whilst they had eaten the tip off every branch of the trees they could reach, they had not touched the buchu.

From the results on the above sites it was readily seen that No. 3 was naturally most favourable to the growth of buchu.

During 1916 a further supply of seed was received from the Forest Department. Further ground was trenched in May, and no manures of any kind used. After a little surface cultivation the seed was sown in June by means of a Planet Jr. Drill set to one inch apart. Thirteen rows, eighty yards in length and four feet between, used up about one and a half pounds of seed. A further half pound was reserved for blanks, and to obtain plants for filling up in the event of bad germination. The germination was slow, but as high as 80 per cent., being much higher than for any previous sowings. The surface soil was kept loose with the Planet Jr. Hoe throughout the season. Very few plants died off at any stage. At twelve months old the plants were from three to six inches high, and continuous enough for a permanent plantation. Where too thick plants were drawn out and transplanted to thicken other places Not more than 10 per cent. of these succeeded.

The seed sown in tins in the Nursery, to supply plants for filling up, germinated badly, certainly not more than 20 per cent., something lower than its usual bad average. These were given the usual nursery treatment of keeping the surface soil moist by watering, whereas those sown *in situ* were not watered, and only had rain on two days in the first fortnight.

At approximately two years old the plants on No. 3 are generally from twelve to eighteen inches high and very bushy, and in good health and vigour.

Harvesting.—The recognised method of gathering buchu is to tear out the branches at their sockets in the crown, leaving a bare stump, which requires two years before this drastic and injurious method can be repeated. That is, a gathering can only be made from the same plant in alternate years. This is a serious drawback in a bread-and-butter endeavour. There must be a limit to this treatment or otherwise the plantation will be killed out. This applies also to plants in a wild state. This biennial loss is not the only adverse result. It must also be recognised that plants subjected to even the most favourable methods of harvesting their leafage cannot also produce seed. We are therefore rapidly travelling to the extermination of the buchu in a wild state unless "Close Seasons" are proclaimed. And a close season of one year's duration will be of no use. A period of not less than two years is required to produce a crop of seed from the last harvesting. Growers should therefore allot a number of their plants for the production of seed for the renewal or extension of their plantation.

The greatest weight of leafage is secured by cutting the whole plant back to *near the crown* at about eighteen months' old for the first time, and so on annually. Cutting each season a little above last season's cut. By this method a harvest is secured annually, and annually increases in weight. The rows will gradually take on the shape of a bushy hedge, the plants gaining in strength and spread.

J. W. M.

THE TWO RUINS AT KIRSTENBOSCH.

IN the early days of the Dutch East India Company Kirstenbosch was an outpost of the little colony and was garrisoned by a small company of soldiers against the marauding Hottentots who had a large kraal at Hout Bay. The wood of the forests " at the back of Table Mountain " had been inspected by van Riebeek and pronounced valuable, and as we know that it was carefully guarded by the Company's orders it is possible that the woodman had his quarters in this locality. It is certain that the garrison must have had a dwelling-house or barracks, but which of the ruins is the remains of this building is not known, though probably it is the one nearer the entrance.

We are on more certain ground at the beginning of the second British occupation, when Kirstenbosch was divided between the Colonial Secretary, Henry Alexander, who succeeded Andrew Barnard, and Colonel Christopher Bird, afterwards Colonial Secretary in Mr. Alexander's place. The property was cut in two by a diagonal line, the portion which went to Colonel Bird including the beautiful little bath which is marked on his grant as "de fontein," and the building nearer to the mountain, at the top of the present Cape Chestnut Avenue. Here he planted Spanish chestnuts, and a few of his trees are still in existence. In Mr. Alexander's portion lies the ruin nearer to the entrance, and here, probably on the site of the earliest dwelling, he built himself a house which was marked by the peculiarity that none of the bedrooms had windows—people went to bed to sleep and not to look at the view, he said. Mr. Alexander was the subject of an attack in a sermon preached in 1810 by the eccentric Dr. Halloran on the text " Alexander the coppersmith did me much evil. The Lord reward him according to his works "——the pith of the reference lying in the fact that the Alexander family, of which the Governor, Lord Caledon, was the head, owed its wealth to copper-mines.

After Mr. Alexander's death in 1818 and Colonel Bird's departure for England a few years later Kirstenbosch reverted to the Government and was subsequently owned successively by the Eksteen and Cloete families, who lived in the house nearer to the entrance, a pleasant gabled homestead shaded by great oaks, probably an enlargement of Mr. Alexander's unventilated country-house.

The ruins at Kirstenbosch have little architectural value, but around them linger many memories of the old days of the Cape. We may picture van Riebeek strolling over—if ever his energy permitted him to stroll—from his farm of Boscheuval, now Bishopscourt, to sit on the stoep and smoke a long pipe with the Company's officer and to hear the latest report of the activities of his Hottentot neighbours, while looking up with satisfaction to the fine native forests with tall trees fit for ships' masts, of which he wrote with such enthusiasm to the Seventeen. Coming down to the early days of the last century, when the larger ruin was an Eksteen homestead, the daughters of the house used to bathe in the little oval bath in the garden, while the slave girls sat in a ring on the bank, clapping their hands and singing to keep away intruders.

These are but some of the visions which any may see who will, when Kirstenbosch is bathed in violet dusk and the long, slanting shafts of sunset light strike across the mountain slopes.

DOROTHEA FAIRBRIDGE.

PROGRESS AT KIRSTENBOSCH.

THE following summary of the principal work done in the Gardens during 1917 is recorded for the information of those members of the Society who are unable to keep themselves acquainted with the progress of the work by frequent visits to Kirstenbosch.

1. The paving and stepping of the paths in the Aloe Kopje has been continued, and has reached a line connecting up the Rustic Bridge in the Fern Dell with the northern slopes of this garden. A contribution of large numbers of several species of Aloes has assisted extension here greatly.

2. A further comprehensive collection of Oxalids has been planted in the Pelargonium Garden to furnish an edging and carpet to the Geranianae.

3. On the opposite site to the Geranianae a large collection of Composites has been planted as a start for a Daisy Garden. The storm water service, kerbing and guttering and formation of paths around these sites have been materially extended.

4. The formation of the Aquatic Pond has been continued as opportunity offered. Various aquatics have been planted and space is available for many more.

5. In order to relieve the overcrowding in the nursery, beds and alternating paths have been laid out near the Entrance Gates, and the shrubby and procumbent Mesembrianthemums planted out to facilitate their taxonomic study.

6. Many of the dormant stems of the Cycads have made good heads during the season, and ferns, trees and plants in their permanent quarters have generally made satisfactory growth.

7. The plants of the Protea Collection have made splendid growth. Prominent among those having flowered were Protea rosacea and Serruria florida. Seeds of the latter have been secured so that its permanent establishment is assured.

8. On the site to be devoted to Economics and research work an area of approximately four acres has been cleared of poplar and other scrub, and the ground trenched and levelled. A portion was planted with Madia, Sesame, Belladonna, Hops, Elderberry, etc. On the remaining ground crops of oats, lucerne and mealies were secured for forage. A post and railing fence has been erected along the Rhodes Road boundary of these grounds, and the boundary on Bishopscourt correctly defined, and a portion fenced with wire and netting. Keen interest has been taken in the Buchu Plantation. Various visits of inspection have been made by growers, and a description of our methods published in *The Farmers' Weekly*. It is hoped to be able to demonstrate improved methods of harvesting this season and finally combat the drastic and injurious methods now in vogue with growers and collectors.

9. The treatment of the unfinished portion of the Fern Dell and Bath was commenced in September, the cost of the work being granted by the Botanical Society.

10. The completion of the new road connecting up Kirstenbosch with Claremont and Kenilworth is at present in abeyance.

J. W. M.

THE ANNUAL REPORT OF THE BOTANICAL SOCIETY FOR THE YEAR 1917.

THE Council is pleased to be in a position to report that the Society has had another successful year. In these difficult times, when public attention is concentrated on the War, it would not have been surprising if the membership roll had shown some falling off, and it is gratifying to report that, on the contrary, it has been well maintained. Your Council is confident that the Botanical Society of South Africa has laid its foundations with solidity, and will creditably maintain its position throughout these trying times, and that its primary object, that of rendering financial aid to the National Botanic Gardens, will be achieved with credit to its members.

The position of the membership roll now stands as follows :—

53 Associate Members, subscribing 5s. per annum.
249 Ordinary Members, subscribing 21s. per annum.
24 Family Members, subscribing 42s. per annum.
46 Life Members, donating £25.
12 Members resigned during the year.
4 Members struck off the roll.
22 New Members joined during the year.

Four meetings of the Council have been held during the year.

At the last Annual Meeting the merging of the Council and Executive was agreed upon, the number of the Council being fixed at 20 members, the following being elected for the year :—

Mrs. Bolus.
W. Duncan Baxter, Esq.
Mrs. Carter.
Advocate R. W. Close.
F. E. Cartwright, Esq.
W. A. Eaton, Esq.
Miss Fairbridge.
Miss W. M. Garlick.
H. T. Twentyman Jones, Esq.
Mrs. Brown Lawrence.
J. Storr Lister, Eeq.
C. E. Pillans, Esq.
Dr. Phillips.
Lady Rose Innes.
A. H. Reid, Esq.
Hon. Mr. Justice Searle.
C. F. Spilhaus, Esq.
Miss Margaret White.
A. Walsh, Esq.
B. G. van Zyl, Esq.

The Right Hon. Sir James Rose Innes, K.C.M.G., was re-elected President, and Sir Lionel Phillips, Sir Lewis Michell, and the Hon. W. P. Schreiner, Vice-Presidents.

The Council appointed Mr. Wm. Duncan Baxter as Chairman, Mr. H. T. Twentyman Jones Hon. Treasurer, and Mr. F. E. Cartwright Hon. Secretary.

From the accounts laid before the members it will be observed that a sum of £233 7s. 5d. has been available during the year from current revenue, which has been paid over to the Trustees of the Gardens, and without which much of the important work would have had to come to a standstill.

Representations having been made by the Gardens Authorities that the upper portion of the Wet Rockery and Fern Glen being still in an unfinished condition, it would prove of great advantage to the Gardens if the Society would sanction the payment of the necessary money for the completion of this most necessary work; and after due consideration it was unanimously resolved that a sum of £200 (Two Hundred Pounds) should be placed at the disposal of the Trustees for this work, which is now nearing completion, and will form one of the most beautiful features of the Gardens.

JOURNAL.—Part III. of the Annual Journal of the Society was published during the year, and circulated to every member of the Society. Arrangements are being made to continue the publication during the coming year.

During the year a lecture was delivered by Dr. E. P. Phillips, on Cape Heaths, on the occasion of the Wild Flower Show in the City Hall, on October 3rd, and thanks are due to him for once more assisting in the work of the Society.

The Council once more desires to emphasize the fact that much of the development and progress of the National Botanic Gardens is dependent upon the support derived from the Society, and consequently it is only by increased membership that this help can be extended. As the great work proceeds of developing what will in years to come undoubtedly be regarded as one of the noted Botanic Gardens

of the world, the need for increased income becomes more and more pressing. The present income at the disposal of the Trustees is altogether inadequate to maintain what has already been accomplished, and at the same time to carry on the further development of the Gardens. Unfortunately the grant from Government instead of having been increased to meet the steady growth of the work at Kirstenbosch, still stands at the reduced figure of £750, to which it was brought down in 1914 as a war measure, and it is only by the sale of surplus trees on the Estate that the Trustees have been able to carry on, even on the present inadequate scale, and it has become evident that in the near future this source of income will be exhausted. The Society can do much to assist the Trustees in their difficult position by increasing the active interest of the public in Kirstenbosch. It cannot be too strongly emphasized that the welfare and progress of the National Botanic Gardens rests in no small measure in this public interest and support.

The appointment of Director of the National Botanic Gardens has now been made, but it is probable that the new Director, who is on military duty in France, will not take up the position until after the close of the war. The appointment has been given to Mr. R. H. Compton, M.A., who will be one of the Professors of Botany at the University of Cape Town.

The thanks of the Society are due to the press for having from time to time published reports of the proceedings of the Society.

The financial statement as passed by the Auditor is attached.

WM. DUNCAN BAXTER.
Chairman.

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AN APPEAL.

The Society is urgently in need of new Members, and every effort is being made to augment the number on present roll. The reduction of the Government Grant to the Botanic Gardens has made it exceedingly difficult for the Trustees to carry out the ordinary maintenance, while further development is impossible except by such grants of money as are given by the Botanical Society.

A proposal form is enclosed with this copy of the Journal, and Members are kindly requested to induce their friends to join, and thus promote the welfare of this great National Institution.

The Botanical Society of South Africa.

OBJECTS :

(*a*) To encourage the inhabitants of South Africa to take an active part in the progress and development of the National Botanic Gardens at Kirstenbosch, a part of the Groote Schuur Estate, in the Cape Province, and to induce them to appreciate their responsibilities therein.

(*b*) To augment the Government grants towards developing, improving, and maintaining fully equipped botanical gardens, laboratories, experimental gardens, etc., at Kirstenbosch.

(*c*) To organise shows at which may be displayed the results of botanical experiments or cultural skill in improving the different varieties of South African flora.

(*d*) To enlighten and instruct the members on botanical subjects by means of meetings, lectures, and conferences, and by the distribution of literature.

FOUNDED JUNE 10th, 1913

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Associate Members enjoy all the privileges of Membership except that they do not vote at any of the Society's Meetings.

Honorary Members may be elected at a Meeting of the Society on the nomination of the Council.

Sympathisers wishing to become members of the Society are invited to communicate with Frank Cartwright, Hon. Secretary, P.O. Box 70, Cape Town.

THE COLLECTION OF SPECIMENS FOR KIRSTENBOSCH.

MEMBERS of the Society are invited to assist in stocking the Gardens with native plants. Specimens from all parts of Africa are desired. At present representatives of the following are particularly needed: *Aloes*, *Bulbs*, *Ferns*, *Protea* (seeds), *Heath* (branches bearing old flowers), and medicinal and other economic plants.

From places within the Union consignments can be sent free by rail or post if addressed :—

BOTANICAL SPECIMENS. O.H.M.S.

To

THE DIRECTOR,

National Botanic Gardens,

Kirstenbosch,

Newlands, Cape.

INSTRUCTIONS FOR PACKING AND SENDING SPECIMENS.

Cotyledons, *Crassulas*, *Euphorbias*, *Aloes*, *Stapelias*, *Mesembrianthema* and other plants of a like succulent nature, and also the *Epiphytic Orchids*, should be packed dry. Each species should be wrapped in paper and laid tightly in a box. Large specimens of *Aloes*, *Euphorbias*, *Cycads*, etc., may be trucked loose.

Large specimens of Tree Ferns should be bound in wet grass or canvas, or with a little damp moss inside the canvas, and the stems should be strengthened with poles.

Ferns, Bulbous and Tuberous Plants in growth and flower need a little damp moss among the roots.

Distinct species of dormant bulbs and tubers, as well as of seeds, should be sent in separate wrappers.

Each consignment should bear (1) the name and address of the sender ; (2) particulars of the locality in which the specimens have been gathered.

Common as well as rare species will be welcome. Fully addressed labels can be had on application.

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THE JOURNAL OF THE BOTANICAL SOCIETY OF SOUTH AFRICA

Edited by R. H. COMPTON, M.A.,
:: :: :: Hon. Director, :: :: ::
NATIONAL BOTANIC GARDENS
:: :: :: KIRSTENBOSCH :: :: ::

Part V. 1919

Published under the authority of the Council of the Botanical Society

Cambridge University Press.

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The Journal of the Botanical Society of South Africa.

PART V. 1919

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I. Panorama from the Kirstenbosch Contour Path, where it intersects the Diamond Stream Path. Pen and ink drawing by Miss M. M. Page Frontispiece.

II. Aloes on the Approach to the Union Buildings, Pretoria. From a Photograph.

III. Aloes on the Kopje behind Union Buildings, Pretoria. From a Photograph.

IV. Leguminosae. Drawn by Miss M. M. Page.

Notes and News.

His Excellency the Governor-General, accompanied by the Hon. Mrs. Baring, her son and daughter, the Hon. Alethea Buxton and Miss Braginton, visited the National Botanic Gardens on 8th September, 1919.

* * *

A special grant of £120 from the Life Members' Fund was voted by the Council of the Botanical Society on 23rd May to enable the rock-work in the upper part of the Fern Dell to be completed. It is hoped that this will be finished in time for the garden party on 13th December.

* * *

The Council of the University of Capetown has approved of the transfer of the Bolus Herbarium to a site in the National Botanic Gardens. This magnificent collection of African plants, in many respects the finest in the sub-continent, was bequeathed to the University by the late Dr. Harry Bolus, together with a capital sum for salaries and maintenance and provision for building. The fine Library of Botanical (mainly systematic) literature will accompany the collection of plants to its new home.

The establishment of the Bolus Herbarium and Library at Kirstenbosch will be of the greatest advantage to the Gardens as the foundation of their scientific equipment; and the Herbarium itself will profit by close association with and easy access to the living material, as well as by its escape from the cramped and inconvenient quarters in which it is at present housed.

The transfer of the Herbarium to Kirstenbosch was keenly desired by Prof. Pearson, and has the warm approval of the Trustees.

* * *

Members of the Botanical Society who have received Buchu seed from Kirstenbosch, and who have any of the dried material for disposal, are invited to let the Director of the National Botanic Gardens know, as he may be able to put them into communication with enquirers.

* * *

A new hard road is now in construction, and is expected to be shortly completed, which will considerably reduce the distance for vehicles between Kirstenbosch and the trams and railway stations at Newlands and Claremont. The road, which has been undertaken by arrangement with the Bishopscourt authorities, will connect Protea Road with Rhodes Avenue, near Protea Church, and will thus cut off the long détour around Fernwood.

* * *

On Wiener's Day, 6th October, 1919, the number of visitors to the National Botanic Gardens was 728.

* * *

In the course of excavations in Southampton Row, London, ancient wooden drain pipes have been unearthed, consisting of tree-trunks hollowed out. Somewhat similar pipes were discovered, it may be recalled, in connection with the old Dutch Bath at the head of the Fern Dell in Kirstenbosch; these are now preserved at the Director's house, pending the erection of a Gardens Museum.

* * *

The Botanical Society's Garden Party is being held at Kirstenbosch this year on Saturday, 13th December.

* * *

Mr. R. Irwin Lynch, M.A., who is known to many in this country in connection with his work on hybridising and cultivating the Barberton Daisies, has retired from the Curatorship of the Cambridge University Botanic Garden owing to ill-health.

* * *

Six cottages for workmen in the National Botanic Gardens have been completed and were passed for occupation in July. The plans and supervision were provided by the Public Works Department, and the cottages are both substantial and picturesque. They are built of the Kirstenbosch sandstone, rough-faced, and are thatched with *Thamnochortus Burchellii*. Each cottage contains a living-room, two bedrooms and a flagged stoep, and a plot of ground for a garden is attached. On completion three of the cottages were occupied as a temporary Hostel for Student Gardeners, and this will continue until the permanent Hostel (see p. 10) is ready. The Government had granted a sum of £1,000 towards the erection of ten such cottages, but owing to the enormous increase in the cost of building this sum was considerably exceeded in the erection of six only, and the Trustees have had to bear a deficit of over £400.

* * *

Mrs. H. H. W. Pearson left Kirstenbosch in June on a visit to England. She expects to return to South Africa at the end of next February.

* * *

There are a few vacancies in the National Botanic Gardens for Women Gardening Student-Apprentices, who undertake a course of study in the cultivation of the South African flora. It is hoped to recruit part of the staff of the Gardens from this source. The course consists of practical gardening work under the instruction of the Curator. The Students live at the Hostel, a very moderate charge being made for board. The Director will send further information, with details of remuneration, accommodation, etc., on request.

* * *

A holiday course of study is being arranged by the Kirstenbosch Hostel Committee, to be held at the National Botanic Gardens, January 5th to 23rd, 1920.

The course will be suitable for teachers and others, and will consist of ecological and systematic work and the preparation of herbarium and museum specimens, under the direction of Mrs. Bolus, Curator of the Bolus Herbarium, who will also conduct various excursions. The Director and Miss E. L. Stephens will give three lectures each on Plant Physiology and the Lower Orders, in connexion with the present Matriculation Syllabus. Seven students can be accommodated at the Kirstenbosch Hostel, at a cost of £6 for the whole period (board, lodging and laundry). The fee for the lectures and excursions is £2. Further information can be obtained from the Secretary to the Kirstenbosch Hostel, "Kincora," Bonair Road, Rondebosch, C.P.

* * *

In the Eighth Annual Report (1919) of the Brooklyn Botanic Garden, we read that the Municipal grant for 1918 (under the stress of war conditions) was $53,229, and that from other sources the Garden received $25,691: the total income being, therefore, at present rates of exchange, about £19,000 sterling. Two endowments of values of $10,000 and $2,500 were made during the year. The income from "Tuition and Sales" was only 1.4 per cent. of the total. (Kirstenbosch in 1918 had a total net income of £2,161, of which no less than 30 per cent. was derived from sales of wood, acorns, etc.—a source of revenue which is now approaching exhaustion.) The staff of the Gardens numbers eighteen, and its activities are wide, including research work, educational and lecturing work, numerous publications of journals, original papers and leaflets, co-operation with Government, Municipal authorities, etc.

PROGRESS AT KIRSTENBOSCH.

The following summary of the principal work done in the Gardens during 1918 is recorded for the information of those members of the Society who are unable to keep themselves acquainted with the progress of the work by frequent visits to Kirstenbosch.

1. The Protea Collection has been extended by the planting out of 450 plants from the Nursery, and also by test sowings *in situ* of several species, which have germinated satisfactorily.

2. On the banks of the Orchid Stream 174 plants of Heaths, embracing about 20 species, have been planted.

3. As portions of the new work around the Bath have been completed suitable material from the Nursery has been planted out. Notable among the plants are:—The Shrubby Sundew, *Roridula Gorgonias*; the Tree Wisteria, *Bolusanthus speciosus* from Rhodesia; the Transvaal Clematis, *C. Stanleyi;* Oldenburgias; Cussonias; *Lycopodium gnidioides*, and *L. cernuum; Actiniopteris australis*, etc.

4. In the Economic Grounds the Canary Islands Forage Shrubs, "Gacia," "Gacia Blanca," and "Tagasaste," have been sown between the lines of Buchu; and also a line of the Cape Blister Bush. Sowings of Egyptian Henbane, Sesame, Soya Beans, Belladonna, Ovombo Corn, Ovombo Beans, Ovombo Pea, and Madia have been made.

Stands of eight varieties of Sweet Potatoes have been planted. Two hundred plants of the Rozelle were planted out on two sites differing in soil and moisture. Propagation of Kikuyu and Rhodes' Grasses was continued, and good blocks have been obtained.

Upwards of 500 lots of seeds and cuttings of various economic plants have been distributed to applicants in all parts of the Union, Rhodesia, and British East Africa.

5. In the path between the Aloe Kopje and Pelargonium Garden 51 yards of a stormwater drain have been laid, and branch drains and catch-pits built to receive the surface water from the paths in the kopje, the whole being connected up with the existing system.

6. Three pairs of semi-detached cottages for workmen are in course of erection on a site roughly bounded by Rhodes' Road, the road under construction to Claremont and the Protea Boundary. Sand, stone and timber are being supplied from the Estate as follows: 158 loads of sand excavated, screened, and delivered to the site; about 700 loads of stone selected and delivered; 300 bags of cement delivered from station to site; 45 yards of concrete stone broken and delivered; logs delivered to sawmill for the supply of 1,200 sq. ft. of flooring boards, and boards redelivered to site. All roof and verandah timbers have been felled, and nearly all delivered to site.

To supply water to these cottages it has been necessary to increase the capacity of the water main from the dam in Diamond Stream to a point opposite the Ranger's Cottage. The ¾-inch pipes have been lifted and replaced with 1½-inch, and the ¾-inch pipes brought forward to extend the supply to the cottages.

The necessary stop-cocks and connections have been fixed to enable the proposed Hostel, and also the stables at their permanent site, to obtain a supply of water from this source.

8. Additional tables and seats have been made for the supply of refreshments to visitors, the old ones repaired, and the site generally improved.

9. The space within the stone kerb of Dr. Pearson's grave has been planted with Florida grass, and the surrounding slopes trenched and graded ready for planting.

10. During the epidemic practically all work was stopped in the Gardens for a period of three weeks. Only a few of the workmen escaped, and these with the Gardens staff were transferred to the local organization dealing with the epidemic. It is pleasing to record that one and all unstintingly and untiringly supported the efforts to suppress the outbreak, with the result that only one workman was lost.

J. W. MATHEWS, *Curator.*

THE HIGH HILLS.

AS you stand on the contour path above Kirstenbosch, you look out across the Cape Flats to where, range behind range, the blue mountains stretch from left to right, from the Great Winterhoek to little Hangklip trailing down into the sea.

In the summer months these mountains are sometimes misty under the south-east haze, but in spring and winter they stand out sharply—glowing amethyst or soft azure, or powdered with snow according to the hour and season. Their history—that is, the record of how and when and by whom they have been ascended—is written in the annals of the Mountain Club: from geologists we may learn how they came into being: but from the old Cape writers we know something of their human interest, of the joys and sorrows, the hopes and fears, the failures and successes upon which they have looked down.

When Jan van Riebeek stood on this spot and looked out towards the mountains in his mind was the thought that somewhere behind them—and not very far behind—lay the land of gold, the great kingdom of the Monomotapa. So great was his faith—based on Linschoten's chart—that the kingdom could be reached with little difficulty that in 1660 he sent out a small expedition. It was to proceed, by way of False Bay, to Cortado, "about 110 miles from this." Thence, past a town called Belugaris to the Monomotapa's capital of Davagul on the banks of the River Spirito Santo, where the emperor's great gold treasure was kept. They would also find the River Camissa, which flowed past Vigiti Magna. It is true that there was a Monomotapa, but far—very far—from van Riebeek's ken when he looked at the blue mountains and dreamed of what might lie behind them. The explorers did not find the emperor, but they saw many other interesting things, such as zebras and a tribe of little people who "clicked in their talk like Calicut Cocks"—meaning turkeys. Still earlier the Fiscal Gabbema had led an expedition inland, and he gave the present names to Klapmuts, the Paarl and Diamant, and to the Great Berg River. It must have been a temptation to find out what lay behind the mountains, for in 1657 three of the freedmen made their way into a "fine moist valley through which a beautiful river flowed, edged with bitter almond trees." So rich and lovely was the district that the natives said proudly that it was *their* Holland or Fatherland, and we know it as Hottentots' Holland to this day.

It must have been a splendid thing to stand on the hill above Kirstenbosch two and a half centuries ago and wonder what land of romance lay behind the mountains. Besides Monomotapa, there was the land of the Chobona, a native emperor, in whose existence van Riebeek had a lively faith, and who—according to the Hottentot convert Eva—ruled over all the Cape natives. His people had large houses of stone and beams, they wore clothes, and sowed white rice and vegetables, and the Chobona's wife was a great lady "abundantly supplied with pearls and golden ornaments," or so Eva said. She was as inventive in story-telling as Scheherazade. But it is time to return from the kingdoms of dreams that lay behind the mountains and dazzled the early settlers with visions of El Dorado.

The peaks of the Winterhoek are conspicuous in winter, being often covered with snow, as are the twin peaks of Mostert's Hoek on their right. The Witsenberg range received its name from the family of Witsen, friends of the van der Stels in Holland, and was so called by Willem Adriaan van der Stel when he rode across the Roode Zand Pass into the Land of Waveren, now Tulbagh. His heart rejoicing in the "pleasant and serviceable country for agriculture or pasture," as he described it, he wrote a persuasive letter to the Seventeen in Holland, urging on them his plan of expansion of the country by colonizing it with "some households who might be willing to go there." A year later he writes with satisfaction of those people who "have spread themselves inland. Consequently," he adds, "under the blessing of God, the Cape promises to grow by the increase of its own people, who—not knowing another fatherland—will not do as the majority of those who come out, and who, when they have managed to scrape together something, again depart, which—as your Honours will be able to perceive—tends to the great injury of this growing colony."

Following the mountain peaks to the right, we come to the range behind Wellington and to the Sneeuwberg, on which the winter snows fall earliest and melt latest. The valley below is rich with fine old farms, though many of the most charming houses are fast being superseded by modern villa residences adorned with gimcrackery. It is strange that a people so conservative in many good old ways should be content thus to transform the dignified houses of their fathers, with their characteristic South African architecture. But Wellington, the old Waggonmakers' Valley, is still a pleasant place, with some unspoilt houses in the neighbourhood. On the knees of the mountain above it is the farm where Piet Retief was born, and where he spent his boyhood. Perhaps—I think certainly—when Dingaan's fierce warriors closed in on him and the last earthly cry that sounded in his ears was "Kill! Kill!" he saw for one brief moment the orange groves of his home and the snow-capped peaks above, wine-coloured in the glow of sunset.

It was another farm in the neighbourhood that Lady Anne Barnard visited with Landdrost van der Riet, where she was horrified at the vast number of oranges consumed by his small daughter. She did not know a South African child's capacity for fruit. At this point Bain's Kloof begins its ascent—that splendid piece of engineering—the road by which you cross the mountains on a level with the eagles' nests, while the Witte Rivier murmurs far below.

In the foreground of the Klein Drakenstein range lie the Paarl Mountains and Simonsberg, and between

them is one of the most radiant valleys in South Africa. From French Hoek, along the course of the Berg River, the Huguenots who were driven out of France by the Revocation of the Edict of Nantes were given grants of land. The names borne by these farms, now the rich fruit farms of the Cape, testify to the homesickness with which the exiles looked back to the land of their fathers. There are Orléans, Nantes, Nonpareil, Versailles, La Cotte, Cabrière, Dauphiné, Burgundy, Rhône, and many others—a Dutch name is the exception—but the French language is as dead as Chaldean. Great hopes were entertained by the Seventeen that the French settlers would cultivate the olive, but it is only in recent years that any success has been achieved—though by a descendant of the Huguenot Jean Mesnard, of Provence.

Simonsberg stands out from the ranges behind it. The little peak on the left is Kannonkop, where the cannon is still to be seen, which in the early days was fired as a signal or warning to the dwellers beyond. On the slope above Hell's Hoogte (the pass between this mountain and Stellenbosch Berg) was a silver mine on which great hopes were based in Simon van der Stel's days, but it proved to have been salted.

Another pair of peaks are those of Jonker's Hoek, which rise above the trout hatchery of to-day, on the land given to Jan de Jonker in the seventeenth century. The Guardian Peak or Haalkop is the next high point in the foreground. Next to this comes Helderberg, and behind them lie the rich valley found by the early explorers in the Hottentots' Holland, with its old farms of Morgenster, Vergelegen, and many another. On the Hottentots' Holland Mountains Sir Lowry's Pass may be seen, and the new railway track, which makes of the ox-waggons of the old travellers, laboriously climbing from level to level, as pathetically inadequate a means of transport as it itself may become in the days of the aeroplane. We must note Kogel Berg, watching over the rise of the Steenberg stream, and hiding from our view Babylon's Tower and the glorious road from Caledon to Hermanus; and so at last we reach little Hangklip, where the great hills slide down into the Indian Ocean.

DOROTHEA FAIRBRIDGE.

BIRDS AT KIRSTENBOSCH.

ONE hears the birds at Kirstenbosch before one actually sees the flowers there, and perhaps the most arresting note of welcome is also the most beautiful—the call of the greater puff-back shrike[1] to his answering mate. The interval between the calls is too long for the sound to become wearisome: rather one longs for another, and yet another, of those loud, clear, full notes that come from deep among the trees, which are the haunts of this dryad. For he scarcely ever comes into the open, except to pass from one leafy mass to another, and when he flies low one gets the impression of a black and white bird, whose wings, barred with a broadish band of white, are decidedly striking. As he closes these his plump rufous or cinnamon-coloured underside shows well. He has the power of raising the soft feathers of his back into the shape of a powder-puff, and is about 8½ inches long, measuring from the tip of the beak to the tip of the tail.

His smaller cousin, the fiscal-shrike[2] (butcher-bird, Jack-hanger), hunts quite fearlessly in the open, and selects the highest point of vantage from which to survey his ground. What a familiar sight he is, like a statue, perched on a wire fence, or the topmost shoot of a pine, body and tail almost vertical, neck shortened, and keen eyes alert! Then perhaps a grasshopper "swims into his ken," and he swoops, a dazzling diabolical mass of black and white, upon his prey. Two or three pecks from that strong curved beak, and the lifeless insect is borne off to be impaled in some convenient larder for immediate or future consumption. Viewed from the gardener's standpoint such actions are useful services, and merit for the fiscal a permanent position on the staff of the National Botanic Gardens. It was no doubt rather for his more cruel habit of attacking small birds that he was called after those officials, the fiscals, who administered justice in the old days of the Cape Colony in such a manner as to have thus "damned themselves to everlasting fame." His usual note is rather harsh and hurried, as if he were irritated or worried, but he can prattle sweet nonsense enough at times to some private audience, so that it is a joy to hear, from below, the soft liquid sounds bubbling forth.

The bacbakiri-shrike[3] is less bold than the fiscal, but at the same time far less shy than the puff-back. He is easily known by the olive-green colouring of the upper part of his body and the yellow of the lower part, with the nearly black chest-band. He flies with his tail spread out so that one sees the conspicuous yellow tip of the tail-feathers. He and his mate sing their duet throughout the year, and it would be hard indeed to have to miss those cheery phrases, which never can become monotonous because of their many variations. Oh, how the young birds practise to attain their art! Early in the morning you may hear one of them gurgling two or three notes over and over again, as if to make quite sure he has these, at least, right. Then he tries something higher in the scale, but it is hopelessly flat, and he again takes refuge in the simple gurgle, while an adult bird gives forth a series of loud tuneful notes, as if to encourage him. At last his efforts are rewarded by success, and the yellow of his feathers becomes brighter, while the beautiful purple-black band appears as a visible sign of victory and achievement.

All three shrikes are said to pair for life, and are always seen about either in couples or alone. Their nests are of the open cup type, and contain three or

[1] *Dryoscopus rufiventris.*
[2] *Lanius collaris.*
[3] *Laniarius gutturalis.*

four eggs. The female is similar, or nearly similar to the male.

In striking contrast to the shrikes are the four honey-suckers, or sugar-birds, that visit the proteas, heaths, and other honey-bearing flowers suited to their long, slender beaks and tongues. The largest of these is the long-tailed sugar-bird,[4] with no beauty of colouring, but with a glorious tail which he delights on occasions to display and flaunt. This tail is much longer in the male, attaining a length of 14 inches, the six centre feathers being prolonged 8 inches beyond the next longest.

The malachite sun-bird,[5] or "long-tailed green," is a smaller bird, having the two middle tail feathers produced during the breeding season, when he is a lovely bit of iridescent malachite-green as he flies or perches in the sunlight. In addition, he has a tuft of bright yellow feathers on each side of the breast, near the wing.

The orange-breasted sun-bird[6] is easily recognized by the predominance of orange and violet on his breast, while the lesser double-collared sun-bird[7] has the prevailing colour scarlet. The latter is slightly smaller than the former, being rather less than 5 inches, and has a square tail. It is he who sometimes hovers, like the humming-bird, when sipping nectar. Except in the breeding season, the males are similar to the brownish-coloured females and young. They build domed nests "with a projecting porch over the side entrance," the eggs being two in number. Besides honey, they all eat small insects, and as they effect the cross-pollination of many of our beautiful flowers they, too, must be reckoned helpers as well as ornaments in the garden.

Another friend to the gardener, this time in a dual capacity, is the little witte-oogie,[8] or white-eye—so-called "from the conspicuous ring of white feathers which encircles the eyes." They go about in cheery, busy little family parties, consisting of the parents and the young of the previous season, or of two or more parties combined, twittering and chirping softly all the time, as they feed on the various scales and other insects. They peck at ripe fruits, and also frequent flowers for honey, thus effecting cross-pollination.

The turtle-dove,[9] being a seed-eater almost entirely, must prevent the growth of many a weed, and it is a pity he is not so frequent at Kirstenbosch as he is in many other places.

Another seed-eater, who must therefore also be classed among the weeders, although he feeds on insects and spiders as well, is the streepkopje[10] or Cape bunting. He is brown and black above, reminding one very much of the sparrow, but distinguished by the streaks across the cheeks. He is a tame little bird, and will come within a few feet to share your crumbs, telling you all the time how friendly he feels towards you.

On the slopes among the brush-wood the tink-tinkie,[11] or Cape wren-warbler, and his mate flit, with loud cheeps and softer chirping notes, in search of insects. He is brownish in colour, but lighter below, and with the throat and breast streaked with black. It is easy to distinguish him by his long tail, which is 3 inches, the whole length of the bird being 6 inches. The nest, with four eggs, is domed and warmly lined.

Another of the warblers, the Cape grass-bird,[12] is to be found in the same sort of place, flying feebly from bush to bush, and peering out from among the twigs with rather a scared look. Towards late afternoon and evening, however, he is less shy, and his warble, heard from various points on the hill-side, is clear and harmonious. A glimpse of him shows a buff-coloured bird with a chestnut and black head, and the under side reddish—a rather untidy-looking bird, measuring about 9 inches.

The Cape fly-catcher[13] is another insect-eater. His song is nearly always audible in the wooded ravines, buoyant and almost defiant, but it is not easy to catch a sight of him, for he moves about very rapidly. The rough impression one gets, after following up the voice for some time, is of a plump little bird about 5 inches long; above, black or very dark with touches of white; below, white and orange-chestnut, the male having a broad black band across the chest.

In the rocky parts at the sides of the ravines live flocks of the rooivlerck,[14] or red-winged spreeuw or starling. They usually breed in colonies, and are recognized by their musical, long-drawn-out whistle and their reddish-chestnut wings. For the rest they are glossy blue-black, and measure about 12 inches. They feed upon larvæ and insects as well as on soft fruits.

Flying high, following the dizzy mazes of the insects they capture, are the swifts. Are those long narrow wings never weary? Now and then one hears them squeaking, as if they were having some game together—the white-bellied,[15] black,[16] and African white-rumped[17] swift.

After watching the perpetual motion of the swifts it is almost a relief to hear the soft rustling sound under trees which often betrays the presence of an olijfkleurige-lijster,[18] or Cape thrush. He is probing with his yellow beak among the damp leaves for worms and other small fry. If he sees you he will fly off hurriedly to the nearest bush or tree, uttering sharp harsh notes of alarm. His usual song, heard best morning and evening, consists of four soft musical notes, the last one fading away almost sadly. He is dark olive-green above and chestnut below, and measures 9½ inches. The sexes are alike, and the young have the mottled plumage which is usual in the thrush family.

[4] *Promerops cafer.*
[5] *Nectarinia famosa.*
[6] *Anthobaphes violacea.*
[7] *Cinnyris chalybeus.*
[8] *Zosterops capensis,*
[9] *Turtur capicola.*
[10] *Fringillaria capensis.*
[11] *Prinia maculosa.*
[12] *Sphenoeacus africanus.*
[13] *Batis capensis.*
[14] *Amydrus morio.*
[15] *Cypselus africanus.*
[16] *Cypselus barbatus.*
[17] *Cypselus caffer.*
[18] *Turdus olivaceus.*

The little Cape robin-chat,[19] jerking his tail up, and hopping about lightly under bushes, is a friendly little fellow. His song is one of the first to be heard in the morning, and often the last sleepy chirp in the evening is his. It can never lose its charm, for one is always in a state of pleasant expectation, not knowing which note is coming next. It sounds rather muddled, but supremely happy and sprightly nevertheless. His other reedy note, which earned for him the name of Jan-frederick, is one of our dearest rustic sounds. He is olive-grey above shading to rufous, and orange-rufous below, and measures about 7½ inches.

Since the pond was made on the lawn we have seen much more of the silent little black swallow,[20] usually late in the afternoon, hawking for flies and mosquitoes. They are shy, and escape observation in the trees that overhang the mountain-streams. Their nests are at the bottom of holes, dug out to a depth of 18 to 24 inches in banks of streams, and one or two pure white eggs are laid.

Among the other visitors to the pond have been three of the waders, viz., the hammerkop,[21] grey heron,[22] and white egret,[23] as well as the large black-and-white giant king-fisher,[24] while a malachite king-fisher[25] with a friend or two stayed for some days in the Gardens. Beautiful indeed he looked, with his red bill, crested crown, and blue back, as he perched on the bulrush, all ready to dart upon his prey.

From the thick bush on the mountain-slopes at various times of the day comes the cry of the noisy francolin,[26] or Cape pheasant—a brown bird with a bill and legs of coral-red, measuring about 16½ inches long. He feeds on young shoots of fern and other herbage as well as on seeds and insects. All these are a happy enough family until those dreaded enemies appear—the black-shouldered kite,[27] or witte sperwel (blue-grey and white), the South African kestrel,[28] or rooivalk (chestnut and dull slate), the African sparrowhawk[29] (dark slate-coloured and brown above, chestnut below)—all 12-13 inches—and the much larger (21½ inches) jackal-buzzard,[30] or jakkals-vogel, so called because his shrill cry is like that of the black-headed jackal.

Although his flight is heavy, there are times when he seems to take the keenest delight in his powers. Wider and wider the circle becomes, and higher and higher he gets, till he disappears on the top of the mountain.

The cardinal woodpecker,[31] or boom-specht, with his crimson head and nape, is among the rare birds at Kirstenbosch.

[19] *Cossypha caffra.*
[20] *Psalidoprocne holomelaena.*
[21] *Scopus umbretta.*
[22] *Ardea cinerea.*
[23] *Herodias garzetta.*
[24] *Ceryle maxima.*
[25] *Corythornis cyanostigma.*
[26] *Francolinus capensis.*
[27] *Elanus caeruleus.*
[28] *Tinnunculus rupicola.*
[29] *Accipiter rufiventris.*
[30] *Buteo jakal.*
[31] *Dendropicus cardinalis.*

Chief among the night-birds are the white and buff screech-owl[32] and the black and white South African nightjar[33]—also known as fern-owl and goat-sucker. *His* "liquid notes that close the eye of day" are heard all through the year—two smaller ones, then three in a descending scale, with a pause on the last note, which makes the song sound rather a sad one. He is sometimes to be seen in the daytime sunning himself, sitting lengthwise on the branch, his flat head almost on a level with his tail, and eyes closed to a slit. No attempt is made at building a nest, the two eggs being laid merely in a depression of the ground under the shelter of a bush or rock. He neither sucks the milk of goats nor does he prey upon small birds, for night-flying insects comprise his diet.

Except for the migratory swifts, all the birds mentioned above are constant residents, but we have one other summer guest, the cuckoo. As the old English thirteenth-century carol has it—

> "Sumer is icumen in,
> Lhude sing cuccu!
> Groweth sed, and bloweth med,
> And springth the wude nu——
> Sing cuccu!"

In our case it is the red-chested cuckoo,[34] piet-mijn-vrouw, or Christmas-bird, who comes from his African winter haunts north of the equator. From October to February the woods ring all day with the male's loud call of three notes, till one is constrained to wish he would undertake the responsibilities of a decent family life, and have much less time for calling. He keeps high up in the trees, and is not often seen, but a fleeting glance shows him to be black and white, with a rufous breast, and about 12 inches long. The cuckoos do not pair. The female lays her egg on the ground and carries it in her mouth to another bird's nest—that of the robin often being selected. There are rumours abroad that she is not such a thorough shirker as we have always been led to believe, and that she has been seen to hang round the nest of the good foster-parents, and even help to feed her young one. Let us hope she may be taking lessons in house-keeping. It is high time she did!

"Bird-Lover."

[*Postscript.*—Since the above article was written my wife had the good fortune to see the black and yellow bishop bird or yellow Kaffir fink (*Pyromelana capensis*) in his brilliant breeding dress, flying swiftly from one tree-top to another, within the Kirstenbosch area. She said that the rich gold of his plumage among the silver leaves—he invariably chose a silver-tree to rest on—formed a colour scheme which would have rejoiced the heart of a bimetallist. "Bird-Lover" informs me that these birds, in addition to grass seeds and grain, eat undesirable insects and feed their young on grubs and caterpillars: the nest is domed with a side entrance, and is woven of fine grass attached to reed-stems: four eggs are laid.—Ed.]

[32] *Strix flammea maculata.*
[33] *Caprimulgus pectoralis.*
[34] *Cuculus solitarius.*

Karroo Ferns and Filmies.

FERNS and Fern Allies viewed collectively consist of a very large number of species differing greatly in themselves and in the conditions under which they thrive or exist. From the delicate transparent fronds only an inch or so long of the Hymenophyllums to the coriaceous fronds six or seven feet in length of our thick-stemmed Tree Fern, *Cyathea Dregei,* are to be found species of every conceivable degree of beauty. In the swamp, along its muddy margin or moist bank, in mountain stream, on dripping krantz or bole of tree, in dark recess, on sunlit ledge, in saturated or arid atmosphere, in sunshine or in shadow, in every imaginable situation and condition members of these families will be found as denizens. There are xerophytes and epiphytes, and why not saprophytes? Pygmies carpet underfoot, giants canopy overhead, twiners enshrouding shrubs, and umbrageous climbers clothing trees, alike testify to the infinite diversity in form and habit.

In all this wealth of material perhaps the most interesting extremes of environing conditions are found in the habitats of the Karroo Ferns and the Filmies.

In the arid atmosphere of the sun-baked kopjes of the Karroo, where, under the usual conception of the conditions of fern life, the last plant expected to be found would be a fern, may be found various species tucked away under boulder or krantz. They are usually on the shady side, but one or two species favour full sun. During periods of drought various species roll up and present a lifeless appearance, which is intensified by the rusty or silvery appearance of the underside of the fronds due to wool or hair of that particular colour. Slight showers of rain, that have not actually touched the plants themselves, will cause them to unfold their fronds, shewing a very fine susceptibility to atmospheric moisture. The soil in which they grow is little more than dust, but under the surface a difference in colour indicates the presence of moisture, if only in a very small degree. The species of this type of fern are included mainly in the genera Pellaea, Cheilanthes, and Nothochlaena, of which the last, perhaps, contains those having the most pronounced characteristics of the type.

For joints and crevices of "dry walls," especially at corners that remain too dry for the usual material used in their embellishment, these ferns would be particularly suitable, especially the evergreen species. For dry but shady places several of our Table Mountain ferns cannot be surpassed, such as *Blechnum australe, B. punctulatum, Pellaea pteroides, Aspidium capense,* etc. With a liberal addition of leafmould to an ordinary soil, a border on the shady side of a building or a site under trees (other than heavily foliaged deciduous ones) will suit them. A heavy fall of leaves and rain combined is detrimental to their well-being, but it is readily obviated by the early removal of fallen leaves.

Passing to the other extreme of a saturated atmosphere, and root-medium in the cool and shady recesses of mountain kloofs and caves, we find the Filmy Ferns. The largest examples of their most delicate loveliness are to be found in the mountain caves of New Zealand, where specimens attain a diameter of several feet. Within South Africa the largest growing species is *Trichomanes rigidum* of Natal and the Transvaal, which grows to twelve or more inches across. The smallest, *Trichomanes montanum,* with fronds about an inch long, comes also from Natal and the Transvaal. This genus is not represented on the Peninsula, but the only other genus of Filmies, *Hymenophyllum,* is represented on Table Mountain by four out of the five certain South African species, one, if not two, of these being confined to it. *H. tunbridgense* is found in all the kloofs on shady damp rocks, boulders and tree stumps. It withstands a considerable amount of drought and sun, but is best in situations constantly shaded and moist throughout the year. It and *H. fumarioides* thrive well where they get a more or less constant drip or are washed by running water at times during winter. The latter is, however, found at its best as a mossy mat in recesses at the base of steep krantzes with a south or south-east aspect. *H. unc inatum,* a new species described by T. R. Sim in his recent work on "The Ferns of South Africa," has only been found once, in 1891, the precise locality not being known. The fourth species, *H. Marlothii,* is confined to two spots only, the one a small patch on the right-hand side of the Disa Gorge, the other in Skeleton Ravine, and constitutes one of the most charming and distinct draperies imagination can conceive. In a sloping recess, in depth and size about equal to a large low window or fireplace, the back is draped almost entirely by this fern. On the inside of the enclosing walls *H. tunbridgense* intermixes with it, but the extension of *H. Marlothii* is clearly circumscribed by the conditions prevailing outside this area, where *H. tunbridgense* thrives in constant drip and buoyant atmosphere. Just as the plant differs in its rusty hairiness from other filmy ferns, so also does its environment differ in the absence of drip and draught, and its rooting medium in the peculiar dissolving sandstone and white clay, or kaolin.

J. W. Mathews.

A HALT ON THE CONTOUR PATH.

AFTER leaving the Celtis Glade and the King of Kirstenbosch, the great black ironwood, if you follow the path on the left towards Window Gorge you come to a still and peaceful spot which is just the place for a halt. The cool, silent woods stretch steeply upwards behind you, hiding the mountain and sky, while on each side the Contour Path winds into the distance. In front is a tangled clearing of brambles, monkey-touw and delicate plants, trailing over the trees and falling from branch to branch. Above may be caught a few glimpses of the Flats and distant mountains, while on the right above the stream towers the rocky side of Window Gorge.

This is an excellent place for a halt, because it is characteristic of the forest-formation as it is found in the Cape Peninsula. Above our heads is the "canopy," the thick covering of tree-tops that makes such a cool shade for the tender forest plants. Among the trees forming the "canopy" at the Halt you will notice all the old friends which you have been passing on the way up, the dainty drooping Halleria, glossy Royena, tough Elaeodendron, the large-leaved assegai-wood, and many others.

At the base of the trees and round our feet spreads the "carpet," another characteristic of the forest-formation. This consists of small shade-loving plants which do not occur in the open sunshine. A pale green, brittle plant with small insignificant greenish flowers springs up everywhere. It is *Leidesia capensis,* one of the Euphorbia family, and grows in large patches all over the woods. Almost as plentiful is the dainty wood-sorrel, *Oxalis incarnata,* with its long slender stems and fragile bell-flowers of palest mauve. On the sloping bank are various small ferns, and on the trunk of a tree near the path is an epiphytic fern, *i.e.,* one which will only grow on some other plant, probably the only species of this habit in the Cape Peninsula. It has long, narrow, lance-like leaves, from which it derives its second name, *Polypodium lanceolatum.* Near the Polypodium you will see another cool-looking plant belonging to the "carpet." It has broad, three-parted leaves and pale greenish flowers, and is called *Knowltonia vesicatoria,* the first name being after Knowlton, once Curator of the famous garden at Eltham. With these is also the small blue *Nemesia chamaedrifolia,* and the darker-leafed *Cardamine africana,* which seems very similar to Leidesia until one notices its three leaflets.

Between the "canopy" and the "carpet" you will find an intermediate layer of taller plants, such as the tangled mass of glaucous bramble, probably a natural hybrid between *Rubus fruticosus* and *Rubus pinnatus,* which bears hardly any fruit, and that very small and dry. It scrambles and climbs by its sharp hooked spines, which catch in other plants and help its long slender shoots to find support. Another good example of spines is afforded by the small tree of *Plectronia ventosa,* which you will see just at the edge of the path. All the way up its slender trunk and right to the tips of its branches it has pairs of spines at right angles to each other. It is thought that the spines probably help to support the young shoots by hooking on to other branches. On the main stem these spines grow very big and strong, but in the young branches they are soft and green, and sometimes bear leaves which show that they are really modified branchlets. With these is a soft, feathery fern, *Hypolepis authriscifolia,* somewhat resembling bracken, and a few very fine arums, *Richardia aethiopica.* There is also a bush of *Cedronella triphylla,* a very aromatic plant with four-angled stems, belonging to the Order Labiatae.

Shading the Cedronella is a tall plant, almost a tree, with large, very woolly, grey leaves and clusters of mauve flowers. This is a Solanum, *S. giganteum,* which becomes very large on the outskirts of the woods.

Up this Solanum a very pretty tendril climber, *Melothria punctata,* is growing. It belongs to the Order Cucurbitaceae, and like all cucurbits, has curious tightly curled tendrils. When the tendril is young it is quite straight, and waves about in the air until it comes in contact with a firm support, round which its sensitive tip immediately curls. The rest of the tendril starts to curl up like a cork-screw too, and then a difficulty arises, for with both ends attached the tendril cannot go on winding in one direction only. So very cleverly it curls up as far as possible in one direction, and then for the rest of its length curls in the opposite direction. A small straight piece is left between the two spirals, and is called the "point of reversal"; and if the tendril is a very long one there are sometimes several of these points, but always an odd number. So far nobody has been able to decide what kind of organ the tendril in cucurbits really is, and it is a subject upon which much controversy has taken place. Another dainty plant is the "Newlands creeper," *Asparagus scandens,* which uses its stem for climbing, twining it round a tree or branch until it reaches the top, where it usually becomes a green feathery mass, clothed with small red berries in the autumn.

Besides the "canopy," the "carpet" and the intermediate layers, there are the woody lianas, another characteristic of the forest-formation. Some of these climb by twining their woody stems round the upright trees, and very often even round their own branches. Another of them, the "wild vine," *Cissus capensis,* has tendrils which are large and branching, and are thought probably to be the terminus of the main stem, the axillary branch becoming the next main stem in each case. Its stems and even leaves

are covered with reddish hairs like wool, and it is a handsome plant in autumn, when its large palmate leaves turn to yellow and red. The other liana represented in the forest-formation at Kirstenbosch is the well-known "monkey-touw," or "monkey-rope," *Secamone Alpini*. This has no tendrils, but climbs by its stem alone, and covers a very large space in the forest, looping from tree to tree and recrossing itself until the forest is a maze of thick rope-like stems, which children so love to climb and swing on. It has narrow, glossy leaves of a dark green, and they are rather far apart on the stem.

Having noted, then, the three layers, carpet, intermediate and canopy, the epiphytic fern and the lianas, you pass on, out of the cool, silent woods to the bright sunshine and the "macchia," or bush formation, full of mysterious rustlings and bright flowers and bird songs.

DORIS PENFOLD.

THE HAROLD PEARSON HOSTEL.

THE Hostel which is to be built in the grounds of Kirstenbosch in accordance with the wishes of Professor Pearson and as a memorial to him will, it is hoped, be completed in the course of the next few months. This Hostel, as is generally known, is intended to promote the interests of the National Botanic Gardens and of South African botanical research work by providing, in this most suitable spot, accommodation for the workers at a very moderate charge. Some of these workers will be women gardeners, girls who will undertake a course of practical training in South African gardening under the direction of the Curator. (See p. 2.) It is hoped to recruit part of the permanent staff of Kirstenbosch from this source. There will be room for others too: for those engaged in botanical research; for workers in the Bolus Herbarium; for students of special subjects such as Mendelism; for painters of the South African flora—in short, for anyone wishing to contribute to the store of the world's botanical knowledge, or to take a share in growing or guarding the wild flowers which elsewhere are being exterminated by cultivation or destruction of the veld. During vacations, also, a certain number of teachers and others might be accommodated at the Hostel, special lectures and excursions being arranged for them. (See p. 2.)

The idea of a Hostel was based on the need of the Gardens for gardeners, preferably for those trained there. More than 1,300 species of living plants are now established at Kirstenbosch (in addition to the 800 species native there), and these require the care of trained gardeners.

The funds for the building have been collected by the Harold Pearson Memorial Committee, and supplemented by the Government. The site is about 100 yards north of the point at which the Rhodes Avenue crosses Window Gorge Stream, and at an elevation of about 300 ft. above sea-level. The soil is light and well drained, and the building will stand among ancient oaks and quinces; the stoep will command a view of the mountains across the Cape Flats.

The plans have been drawn by the Public Works Department in conjunction with the Harold Pearson Memorial Hostel Committee. The building will be of the sandstone found at Kirstenbosch, and the soft tints of cream and yellow and brown will form a pleasant contrast to the thatch of the sloped roof. The thatch, which comes from Tygerberg, is the gift of Sir David Graaff; the stone, sand, and much of the timber is being provided by the Trustees. The design of the Hostel has been kept on simple lines, bearing in mind the plainer forms of old Dutch houses, such as the Chaplain's House at Bishopscourt, and is **T**-shaped, as many of the houses were. If at any future time expansion is desired, it may easily be achieved by the addition of a wing across the foot of the **T**, converting it into an **H**-shaped house. Accommodation is provided for ten residents and a warden; there will be large living and dining-rooms and a pillared stoep, and a space will be set apart for a private garden.

This Hostel is to be raised to the memory of Harold Pearson, and all who dwell in it may take their share in carrying out the work to which he devoted his life—the advancement of South African botanical knowledge and the development of the gardens at Kirstenbosch.

D. F.

OUR ALOES: THEIR HISTORY, DISTRIBUTION, AND CULTIVATION.

BY I. B. POLE-EVANS, M.A., D.Sc., F.L.S.

I HAVE been invited to write something for this JOURNAL on the subject of our Aloes. I gladly comply with the request, because there is abundant evidence throughout the country that any information on this subject at the present time will be welcomed by the public, many of whom are rapidly developing a taste for the cultivation of these fascinating and beautiful plants.

Aloe gardens and rockeries are becoming fashionable in South Africa, as they did in Holland and Britain at the beginning and middle of the eighteenth century, and it behoves the botanist to encourage this healthy appetite on the part of the public in every possible manner, and supply the necessary information whereby their cultivation may be taken up as a means to an end and made an interesting study, whether it be for the purposes of hybridization experiments—a field which offers enormous possibilities both for the horticulturist as well as for the plant breeder—or whether it be for beautifying our gardens, or rendering our present imperfect knowledge of these plants more complete.

I shall show later on that there are many Aloes of reputed South African origin which have been under cultivation in Holland and England for at least one and two centuries, but which to-day are unknown in South Africa.

Anyone who can rediscover these plants in South Africa or throw any light on their origin will be conferring a benefit on botanical science. Collectors and cultivators should therefore make a point of labelling their plants, and should record their source of origin, otherwise their botanical interest and value is very greatly depreciated, and the collector and cultivator may become a mere pedant, like the man who builds up a herbarium and imagines that its value depends on the number of specimens he is able to accumulate from year to year.

The Aloe has long been an object of admiration and interest in civilized countries, for ancient writers record its cultivation in pots in Rome and Naples. While the origin of such plants may remain obscure, the distribution is now fairly well known.

All are inhabitants of the Old World, and Africa may be regarded as their home. Some 200 species of Aloe are recorded; of these about 190 inhabit the African Continent and its adjacent islands, while some 6 species are found in Southern Arabia. One occurs both in Southern Arabia and the adjoining territory Eritrea, and one species grows in the Cape Verde Islands, in Southern Arabia and in India. Of the African species South Africa can claim at least 110, while the remainder occur in the neighbouring islands, Tropical, Central and Northern Africa.

The earliest known Aloes from South Africa naturally came from the Cape of Good Hope. The first that was cultivated in European gardens was *A. succotrina* Lam. It was one of the treasures grown in the Botanical Gardens at Amsterdam under the care of Johan Commelin as far back as 1697, in which year the plant was figured and described in his *Horti Medici Amstelodamensis*.

Although this plant has been so long under cultivation, like many of its congeners, its actual home in South Africa long remained unknown until Dr. Marloth, some fourteen years ago, recorded *A. succotrina* as occurring on the slopes of Table Mountain, just above Newlands, at an altitude of 1,200 feet. These plants now form one of the natural treasure spots at the National Gardens at Kirstenbosch. Like many others of the genus, it has an extraordinarily local distribution. As far as is at present known, it only occurs naturally on the slopes of Table Mountain above Newlands and on rocks of the Little Lion's Head near Hout Bay, in the Cape Peninsula.

At the beginning of the seventeenth century some nine or ten further species were sent from the Cape to Europe. The Governor, Adrian van der Stel, was responsible for these introductions, and they in turn were described by Caspar Commelin in 1701 in the *Horti Medici Amstelodamensis*. They include *A. plicatilis, A. saponaria, A. brevifolia* var. *postgenita*, and *A. arborescens*, all well-known plants. *A. plicatilis* is still a familiar object on the hills near Tulbagh. *A. saponaria* is common along the coast from Hermanus eastwards. *A. brevifolia* var. *postgenita* occurs on the hills at Caledon, while *A. arborescens* often dominates the vegetation in the neighbourhood of Mossel Bay.

Of the plants sent back to Holland by Governor van der Stel during the years 1701-02, Caspar Commelin, in his "Præludia Botanica," figured and described in 1703 *A. africana, A. brevifolia* var. *depressa, A. ferox, A. glauca, A. humilis, A. supralaevis*, and *A variegata*.

Of these *A. africana*, a tall arborescent species with one to three spikes of bright yellow flowers, is typical of the vegetation in the coast-belt between Port Elizabeth and Port Alfred.

Although *A. brevifolia* var. *depressa* is common in European gardens, its natural home and habitat in South Africa to-day is unknown. *A. ferox* is widely distributed throughout the south-eastern parts of the Cape Province, and extends its range from Swellendam to Pondoland.

A. glauca, which has been described and figured in many European works, has so far not been traced to its original locality in this country.

A. humilis, a rather small and inconspicuous plant, of which there are at least some seven varieties, is confined to the eastern parts of the Cape. It is to be found at Port Elizabeth and Somerset East.

A. supralaevis must be regarded merely as a variety of *A. ferox,* while *A. variegata,* the "Kanniedood" of the colonist, has a wide distribution, occurring in the Karroo, the Karroid plateau, and South-West Africa.

Thus up to 1703 the following Aloes were known from the Cape: *A. succotrina, A. plicatilis, A. saponaria, A. brevifolia,* two vars., *A. arborescens, A. africana, A. ferox, A. glauca, A. humilis,* and *A. variegata.*

Some thirty years later two more Aloes from the Cape were added to the European collections, viz., *A. mitriformis* and *A. obscura.* These novelties were figured by Dillenius in 1732 in his "Hortus Elthamensis."

A. mitriformis, of which there are at least six distinct varieties, is confined in its distribution to the mountain slopes of the Cape Province, and nowhere does it extend its range north of the mountains bounding the Karroo region. It seems highly probable that the early introductions of this plant to Europe came from the Caledon district. Little can definitely be said about the origin of *A. obscura* except that it undoubtedly originated from the Cape of Good Hope, and was known to European horticulture during the eighteenth and nineteenth centuries under a variety of names, such as *A. perfoliata* var. *obscura, A. saponaria* var. *obscura, A. picta* var. *major, A. maculosa* and *A. maculata.* I have seen no living specimens of Aloe from South Africa which answer to the description of this plant, but am inclined to agree with Haworth that it is merely a variety of *A. saponaria.*

Miller, in the 8th edition of his "Gardeners' Dictionary," published in 1768, mentioned eleven species of Aloe from the Cape as worthy of cultivation.

The younger Linnaeus in 1781 described *A. spicata* and *A. dichotoma* from the Cape. Considerable doubt exists to-day as to the exact identity of the former plant; Thunberg, in his "Flora Capensis," states that it grows in the interior regions of the Cape of Good Hope, and that it flowers in August. The latter plant is commonly known as the "Koekerboom" or "Quiver Tree," and is confined to the mountains of the Western Cape, Namaqualand, and South-West Africa.

Some eight years later William Aiton, in his "Hortus Kewensis," recorded three more Aloes from the Cape, viz., *A. serrulata, A. lineata,* and *A. purpurascens.* Of these *A. serrulata* is unknown in South Africa to-day, and it seems quite possible that the plant may be nothing more than a hybrid from *A. variegata. A. lineata* is typical of the vegetation in the eastern parts of the Cape, especially in the neighbourhood of Grahamstown. In fact, it is confined to the eastern portion of the Province. *A. purpurascens* has an interesting history. Although it has been cultivated in European gardens since 1780, its place of origin from South Africa remained unknown till 1912, when Dr. Marloth, in a communication to the "Royal Society of South Africa," reported the presence of *A. purpurascens* on rocks near the mouth of the Kleyn River.

The first detailed account of the genus was published by Haworth in 1801 in the *Transactions of the Linnean Society* of London. Haworth had been collecting and cultivating Aloes for some fifteen years before his monograph appeared. At this time he included 59 species under the genus, and did not differentiate between the genera *Apicra, Haworthia, Gasteria,* and *Aloe.*

As a result an analysis of Haworth's paper reveals the fact that not more than nineteen good species are recorded. He, however, described two new species in this monograph, viz., *A. nobilis* and *A. striata,* both of which had probably been brought back from the Cape by Francis Masson. *A. latifolia,* which was also collected at the same time by Masson, Haworth regarded merely as a variety of *A. saponaria,* with which many botanists will, I think, agree.

A. striata, which is perhaps one of the best-known Aloes in South Africa, and is commonly referred to as the "Coral" Aloe, is confined to the Cape Province and Great Namaqualand, the Karroo being its northern boundary. The plant has been extensively used by gardeners for hybridizing purposes, and a number of extremely interesting and showy hybrids have been raised.

A. nobilis is not so well known. It may be nothing more than a variety of *A. mitriformis.* Its locality is unknown.

Haworth in 1812, in his "Synopsis Plantarum Succulentarum," adopts Duval's two new genera *Gasteria* and *Haworthia,* and describes 30 species of Aloe from the Cape. No new species are recorded in this work, but he raised *A. latifolia* to the rank of a species, and added the following observation to his description of *A. saponaria*: "Having raised a great quantity of this from seeds every one of which exactly resembled the parent, I have no hesitation in giving it as a distinct species from the preceding" (*A. latifolia*).

Haworth also regarded *A. ferox* and *A. supralaevis* as distinct species, and included two varieties of *A. mitriformis,* one of *A. brevifolia* and four of *A. humilis* as separate species. If we omit these varieties, it may be said that 23 species of Aloe were known from the Cape at this time. The localities from which *A. spicata, A. nobilis, A. glauca, A. serrulata, A. obscura,* and *A. virens* were obtained are, however, obscure to-day, and until more information is obtained of their occurrence in South Africa, *A. spicata, A. glauca, A. serrulata,* and *A. obscura* can hardly be regarded as typical and valid species.

Bowie visited the Cape between 1817 and 1830, and sent back to Kew amongst his collections: *A. myriacantha, A. micracantha, A. aristata, A. ciliaris, A. tenuior, A. striatula, A. pluridens, A. gracilis* and *A. stans.* These, with the exception of the last two mentioned species, were described by Haworth between 1827 and 1829 chiefly in *Taylor's Philosophical Magazine.* All with the exception of *A. gracilis* are found in the eastern portion of the Cape.



PLATE II.

Aloes on the approach to the Union Buildings, Pretoria.



PLATE III.

Aloes on Kopje behind the Union Buildings, Pretoria.

A few years later, in 1829, an interesting and at the same time extremely handsome Aloe was described from South Africa as *A. Salmdyckiana* by Schultes in Roemer and Schultes' "Systema Vegetabilium."

Although this plant was one of the most desirable from an ornamental point of view, and had been in cultivation for many years in Europe and the Cape, its origin and exact locality remained obscure until quite recently, when in July, 1915, I was fortunate enough to discover a large number of plants at Mossel Bay. The examination of this material in its native habitat left no doubt whatever in my mind but that *A. Salmdyckiana* was nothing but a natural hybrid between *A. ferox* and *A. arborescens*.

In Europe at this time Prince Salm-Reifferscheid-Dyck had made a great collection of Aloes and other South African succulents. These were described in various papers from 1817 to 1863. Between 1836-49 Salm-Dyck published a beautifully illustrated monograph on the Aloes, wherein some 34 species were recorded from South Africa. Four of these species, however, are best regarded as merely varieties of *A. mitriformis*.

Salm-Dyck's Monograph was nevertheless the means of bringing to the notice of botanists five new Aloes, viz., *A. caesia*, *A. consobrina*, *A. Ecklonis*, *A. grandidentata* and *A. microstigma*.

A. caesia was introduced into European gardens about 1815. Its place of origin in South Africa is, however, unknown, but J. G. Baker states that it was collected by Cooper later on on the Zuurberg Mountains. The plant is at present unknown in South Africa, but from the published descriptions I am inclined to think that it also may be a natural hybrid. *A consobrina* is unknown in South Africa to-day, although it was introduced into European gardens about 1845. Salm-Dyck's figure strongly suggests that it may possibly be a natural hybrid, too, with *A. tenuior* as one of the parents. *A. Ecklonis*, one of our deciduous Aloes which is typical of the grass veld country, has a wide distribution. It occurs as far south as Grahamstown, and extends its range to the high veld grassland of the Northern Transvaal. *A. grandidentata* is one of the typical succulents found in the semi-arid belt of country between Kimberley and Mafeking. *A. microstigma* is also one of the typical plants found in the Karroo region, and may be seen in the Addo Bush, Hex River Pass, at Laingsburg and Touws River.

The figures in Salm-Dyck's beautiful monograph of such well-known species as *A. grandidentata*, *A. arborescens*, *A. microstigma*, *A. africana*, *A. supralaevis* illustrate very clearly what a false impression of the general habit and appearance of these plants may be given when they are grown beyond their natural range and under unnatural conditions. It is somewhat remarkable that such an ornamental plant as *A. striata* should have been omitted from this work.

In 1858 Thomas Cooper, on behalf of Wilson Saunders and the Royal Horticultural Society, visited the Cape for the purpose of collecting some of its botanical treasures. As a result of Cooper's travels through the Colony and Natal eight additional species of Aloe were recorded. These were: *A. Cooperi*, *A. drepanophylla*, *A. macracantha*, *A. leptophylla*, *A. Greenii*; *A. pratensis*, *A. sigmoidea*, and *A. Thraskii*.

A. Cooperi was first collected by Burchell in 1814 near Uitenhage. It was rediscovered by Cooper in Natal in 1862, and described by Baker in the *Gardener's Chronicle* twelve years later. *A. drepanophylla* is said to have been collected by Cooper on the Zuurberg Range and in the Somerset Division of the Cape. It has been cultivated in England since 1860. The plant is of rare occurrence in South Africa, and the only plant which I have seen which in any way approaches the description is in the magnificent Aloe garden of Mr. R. W. Rose-Innes, of Kingwilliamstown. The plant conveys the impression that it may possibly be a natural hybrid between *A. arborescens* and *A. speciosa*. The remaining six species which were secured by Cooper were described by J. G. Baker in 1880 in a paper on the Aloineae and Yuccoideae published in the *Journal of the Linnean Society*. *A. macracantha*, whose exact locality was unknown until recently, is from my own observations and collections of frequent occurrence in the thorn country between Greytown and Weenen in Natal. The plant flowers regularly in the Aloe collection at Pretoria, and is, as Baker pointed out in the *Botanical Magazine* for 1881, "the finest of all the spotted Aloes." *A. leptophylla* is another one of those plants which is apparently well known in the Aloe collections of Europe, but which cannot be located in South Africa to-day. It is reported to have been collected by Cooper about 1860 not far from the town of Worcester, in the Cape Province. The plant has much the general habit and appearance of *A. latifolia*, but the leaves are thinner in texture and recurved, while it bears a dense capitate raceme of bright orange-yellow flowers. *A. Greenii*, which had also been in cultivation in Europe from about 1860, is one which long remained without being run to earth, although the late Dr. MacOwan had stated that it came from Natal. From my own observations and collections I can say that the plant is plentiful in the neighbourhood of Pietermaritzburg.

A. pratensis is fairly common in the grass veld from Grahamstown to Durban, and as far as I am aware does not extend its range westwards further than the Drakensberg Mountains. *A. sigmoidea* is another plant about which some definite information regarding South African material is badly needed before this can be regarded as a valid species. It is stated to have been collected by Cooper in the Amatonga Country, but the flowers were unknown when Baker described it. It is probably only a variety of *A. ferox*. *A. Thraskii* has long been credited to the Orange Free State flora. Dr. Marloth, however, was the first to point out that this was a mistake, and that the plant is confined to the coast belt of Natal. The plant is a feature in the vegetation on the steep slopes of the Bluff at Durban, and is plentiful at Amanzimtoti and Port Shepstone.

About 1870, specimens of the giant tree Aloe, *A. Bainesii*, from Kaffraria, were introduced into Europe, and attracted considerable attention. The plant was first described by Sir William Thiselton Dyer in the

Gardener's Chronicle for 1874, where the differences between the tree Aloe of the West Coast, *A. dichotoma,* and *A. Bainesii* of the East Coast were pointed out. *A. Bainesii* occurs along the coast belt from Kaffraria to as far north as the forests of Portuguese East Africa.

I have mentioned above Baker's "Synopsis of the Aloineae," which apeared in 1880. In all, he recorded in this paper some 61 species of Aloe from South Africa; of these, three of his new species—viz., *A. Atherstoni, A. Bolusii* and *A. MacOwani*—may be discarded, as they proved to be nothing more than *A. pluridens, A. africana* and *A. striatula* respectively. It also seems more appropriate to remove his *A. Bowcia* to a separate genus, while his *A. albispina* may better be regarded as a variety of *A. mitriformis.* This brings the total number of species recorded at this time down to 56; the exact localities of 13 of these, however, are unknown in South Africa to-day, and until more information is forthcoming regarding them they must be accepted with considerable caution. They are: *A. virens, A. serra, A. glauca, A. serrulata, A. obscura, A. gasterioides, A. tricolor, A. consobrina, A. spicata, A. platylepis, A. drepanophylla, A. sigmoidea and A. chlorolcuca.* If the above are omitted, then it may safely be said that 43 valid species of Aloe were known from South Africa up to the year 1880.

It may be worth while to pause for a moment and examine in detail Baker's new species, described in the paper just mentioned. They are 10 in number. Three of them, *A. MacOwani, A. Atherstoni,* and *A. Bolusii,* I have already indicated, must be dropped, while two of them, *A. sigmoidea* and *A. Thraskii,* I have dealt with under Cooper's spoils; of the remainder only two are known with any degree of certainty in South Africa at present, viz., *A. nitens* and *A. speciosa.*

A. nitens was first sent to Kew in 1877 by Sir H. Barkly when Governor of the Cape. Like many of its confrères, its place of origin has long remained a mystery. I was, however, fortunate enough to rediscover the plant in the valley of the Tugela in July, 1916. It is the tallest of the arborescent Aloes known to me.

A. speciosa is one of our well-known species, and is commonly found on the steep kranses in the eastern parts of the Cape. It occurs in the Addo and Kowie Bush, near Alicedale and Pearston. *A. gasterioides* and *A. chlorolcuca* are unknown to me. The localities for both are merely given as Cape of Good Hope. *A. tricolor,* from the published description, I regard as nothing more than *A. grandidentata.*

Amongst his less-known species Baker includes *A. claviflora* Burch, and *A. falcata.* The former I think is very probably *A. Schlechteri* Schönland, while the latter is known from Little Namaqualand.

In 1896 the Aloes were worked up in the "Flora Capensis," vol. vi., again by Baker, and some 68 species were described from South Africa. Eight new species were added to his previous list: apart from these, little addition to our knowledge of the group was made. The new species included *A. minima* and *A. Boylei* from Natal, *A. kniphofioides,* collected by Tyson in Pondoland, *A. Monteiroi* from Delagoa Bay, *A. rupestris* from Little Namaqualand, and *A. Brownii, A. longiflora* and *A. fulgens* "without locality." Nothing has been added to our knowledge of *A. Brownii* and *A. longiflora* since they were first described, while *A. fulgens* is undoubtedly only a form of *A. Salmdyckiana.* Of the 68 species recorded from South Africa in the "Flora Capensis," only 47 can be clearly located in the country to-day.

A. hereroensis, which was described in 1888 from South-West Africa, and is of frequent occurrence in the Kenhardt, Prieska, and Griqualand West districts of the Cape, is, I should point out, not mentioned in the "Flora Capensis." The plant was first described by Engler from material collected by Dr. Marloth in Hereroland in 1886.

Towards the close of the nineteenth century three more Aloes from South Africa were recorded. *A. rubrolutea* was described by Schinz in 1896 from Great Namaqualand, Hereroland and the Kalahari. In the following year Medley Wood and Evans described the beautiful little *A. Marshallii* from near Glencoe, in Natal, while from the Transvaal Kuntze, in 1898, described *A. transvaalensis.* At the same time he also described an Aloe from East London as *A. caeadensis.* This latter plant I have not seen, and it certainly is not sufficiently well known to warrant its being included at present amongst our typical Aloes.

In 1903 Dr. Schonland, in a paper published in the *Records of the Albany Museum,* carefully reviewed the genus, and pointed out how incomplete our knowledge was of the localities from which many of the plants were obtained. He also drew attention to the desirability of drawing up descriptions from plants actually growing in the country, on account of the abnormal appearances which they were liable to assume under European conditions and cultivation. In addition to supplying much valuable information regarding many well-known types, Dr. Schönland, in this and several other papers also published in the *Records of the Albany Museum* up to 1907, described some ten new species of Aloe. These included *A. Chabaudii* from the Zambesi, *A. Greatheadii* from Bechuanaland, and *A. parvibracteata* from Delagoa Bay. Four species were described from the Transvaal, viz., *A. Davyana, A. Dyeri, A. castanea,* and *A. Peglerae,* while from the Cape three species were also described—*A. Broomii, A. Schlechteri* and *A. parvispina.*

A. Chabaudii, when in flower, is one of the most attractive plants of the genus, and is eminently suitable for rockeries. It has a wide distribution in the Northern and North-Eastern Transvaal, and is not uncommon in Rhodesia. It occurs plentifully in the Crocodile River Valley from Komati Poort to Crocodile Poort, and is also found in the Zand River Valley and along the Ingalele River. *A. Greatheadii* is extremely common throughout the Limpopo Basin in the Northern Transvaal, and may be seen in abundance at Smits Drift, and along the Chunes and Olifants Rivers.

A. parvibracteata is common on the cliffs at Delagoa Bay, and is of frequent occurrence in the low country between Delagoa Bay and Komati Poort. *A.*

Davyana is common on the hills around Pretoria, and usually flowers during March and April. *A. Dyeri* is one of the handsomest plants of its section, and as Dr. Schönland points out, "is a most graceful foliage plant." Schönland's description was drawn up from a plant received from Kew. The precise locality for *A. Dyeri* has for some time been obscure. I may state, however, that from my own observation the plant is to be found in the shady kloofs around Barberton. *A. castanea,* a tall arborescent plant with remarkable chestnut-coloured flowers full of dark-coloured honey, is to be found in the valleys of the Olifant's, Steelpoort, Waterval and Spekboom Rivers. *A. Peglerae,* a most pleasing plant, occurs along the Magaliesberg and Witwatersberg ranges.

Of the Cape species, *A. Broomii* has a wide distribution in the central districts of the Cape, and extends its range into the hills on the southern boundary of the Orange Free State. Dr. Broom informs me that it may be found at Herbert, Hopetown, Victoria West, Beaufort West, Murraysburg, Middelburg, Colesburg, Springfontein and Burghersdorp. *A. Schlechteri* occurs plentifully in the north-western and central districts of the Cape, and extends its range well into the Karroo.

The description of *A. parvispina* was drawn up from material colected by Zeyher on the Heerelogements Mountain. Living specimens should be obtained before final judgment is passed on this plant.

Botanical science is indebted to Dr. Marloth for the discovery and descriptions of two very remarkable Aloes from the Cape during the year 1904. I refer to *A haemanthifolia* and *A. comosa,* the former from the mountains at French Hoek, the latter from the Doorn River Valley between Clanwilliam and Van Rhynsdorp. Both plants are unique. *A. haemanthifolia* is not more than a foot high, and has six to eight broad strap-shaped leaves distichously arranged. The flower stalk is unbranched, and bears a short raceme of densely-crowded rose-pink flowers. *A. comosa* is a tall arborescent plant reaching a height of 9 to 12 feet. It bears from one to five elongated flower spikes which are crowded with bright pink flowers.

I must also not overlook a very handsome and attractive Aloe which was described at this time in the *Gardener's Chronicle* for 1906 by Mr. N. E. Brown as *A. laxiflora.* The plant is frequent in the bush around Port Elizabeth and Uitenhage, and when grown in clumps, as is done in the St. George's Park at Port Elizabeth, affords a glorious sight never to be forgotten by those who appreciate the charms and associations of their local flora.

In 1908 the genus Aloe was worked up by Alwin Berger in Engler's *Das Pflanzenreich.* Berger at that time had had the advantage of studying the extensive collections of succulents in the late Sir Thomas Hanbury's garden at La Mortola, in Italy, where many of our South African plants can be grown to perfection.

Berger's work on the Aloe is the most complete and exhaustive treatise on the subject that has yet appeared, and much of the information quoted above has been culled therefrom.

Berger in this work describes eight new species from South Africa, and records in all 91 species from this country. In the light of our present knowledge practically nothing is known about twenty of these species in South Africa to-day, although many of them have been cultivated in Europe over a considerable period; hence the desirability of collecting and cultivating these plants must be apparent to all who are interested in our flora apart from its æsthetic aspect.

Since the publication of Berger's work in *Das Pflanzenreich* some fifteen new species of Aloe from South Africa have been described.

Dr. Marloth, in the *Transactions of the Royal Society of South Africa* for 1910, described *A. Krapohliana* from Little Namaqualand, while Dr. Schönland, in the *Records of the Albany Museum* in 1911, gave a very full description of *A. Pearsoni,* which was collected by the late Dr. Pearson in Namaqualand at Numies Mine, Brakwater pools and Kuboos.

In 1915, in the *Transactions of the Royal Society of South Africa,* I published descriptions of six new Aloes from the Transvaal, viz., *A. longibracteata, A. Pienaarii, A. Wickensii, A. globuligemma, A. pretoriensis* and *A. aculeata;* in the same publication a description of *A. suprafoliata* from Swaziland was given in the following year, while six more Aloes from the Transvaal were described in the same Society's *Transactions* for 1917, and included *A. verecunda, A. Simii, A. Barbertoniae, A. petricola, A. sessiliflora* and *A. Thorncroftii.*

Of the smaller and deciduous species most suitable for cultivation I would recommend: *A. myriacantha* var. *minor* Berger, *A. Cooperi* Bak., *A. Ecklonis* Salm., and *A. Marshallii* Wood and Evans. Of the smaller varieties with rigid leaves *A. Peglerae* Schönland, *A. aristata* Haw., *A. brevifolia* Mill., *A. brevifolia* var. *postgenita* Roem and Schult., *A. variegata* L., *A. pratensis* Bak., and *A. suprafoliata* Pole-Evans are perhaps the most attractive.

Of the medium-sized plants *A. striata* Haw., *A. macracantha* Bak., *A. saponaria* (Ait) Haw., *A. saponaria* var. *brachyphylla* Bak., *A. Dyeri* Schönland, *A. grandidentata* Salm., *A. Schlechteri* Schönland, *A. petricola* Pole-Evans, *A. Thorncroftii* Pole-Evans, *A. Chabaudii* Schönland and *A. mitriformis* Mill. can be recommended.

Of the larger stemless forms *A. Wickensii* Pole-Evans, *A. Pienaarii* Pole-Evans, *A. globuligemma* Pole-Evans, and *A. aculeata* Pole-Evans make a fine display.

A. ciliaris Haw., *A. ciliaris* var. *Flanaganii,* and *A. tenuior* Haw., may be used with advantage as climbers and creepers.

As bushy herbs, *A. laxiflora* N. E. Brown, *A. striatula* Haw., and *A. commixta* Berger, may be used.

For larger shrubs, *A. arborescens* Mill., *A. Salmdyckiana* Schult.f. and *A. plicatilis* (L.) Mill. are suitable.

Of the tall-stemmed plants *A. comosa* Marloth, *A. pluridens* Haw., *A. speciosa* Bak., *A. africana* Mill., *A. candelabrum* Berger, *A. ferox* Mill., *A. Marlothii* Berger, *A. nitens* Bak., *A. rupestris* Bak., *A. excelsa*

Berger, *A. Thraskii* Bak., are useful for a background.

As trees *A. dichotoma L.f.* and *A. Bainesii* Dyer may be used.

There is still another Aloe which I should mention, and which is above all worthy of cultivation. It is, so far as I am aware, peculiar to the high mountains of Basutoland. Dr. Schönland, who first brought it to my attention, proposes to describe it as *A. polyphylla*. The plant is composed of a dense rosette of leaves, and measures from 12 to 16 inches across. The leaves are 60 to 80 in number, and are arranged in a strongly spiral manner. They are pale glaucous green with a lighter margin, which bears thorns of a similar colour. The upper surface is smooth, while the lower surface is armed near the tip with three to four obliquely-placed thorns. I have not seen the plant in flower, but it evidently belongs to Berger's section *Rhodacanthae*.

If we include this plant, omit the 20 less-known species already mentioned, and regard *A. ferox* and *A. supralaevis* as one species, which I am inclined to do, then we may say there are at least 86 well-known species of Aloe endemic to South Africa.

Since they are found in the four Provinces, the Cape, the Orange Free State, Natal, and the Transvaal, in the native territories of Basutoland and Swaziland, and since they occur also in Namaqualand, British Bechuanaland, and Portuguese East Africa, surely no more suitable or representative a plant could be found to fulfil or embody the requirements of our national flower.

From the very earliest times they have adorned the cities of civilization. They have long been the objects of admiration, cultivation, and study in the Gardens of Amsterdam, Leiden, London, Eltham, and Cape Town. They occur in the desert wastes and on the rocky slopes; they flourish in the low-lying vleis and on the grassy plains, and they enliven the mountain peaks and forest scrub with their vivid hues. They are capable of cultivation in almost every part of South Africa.

The Aloe thus might well be adopted as South Africa's national emblem.

Our illustrations depict a couple of views of the Aloe collection at the Union Buildings, Pretoria. This is the largest collection of South African Aloes in existence. The collection was begun early in 1912, when the Division of Botany was first housed on the site which it at present occupies just below the Union Buildings. During the months of May, June, and July these Aloes are in full bloom, and with their attendant sun-birds afford a sight well worth a visit.

The Botanical Laboratories of the
Union of South Africa, Pretoria.

October, 1919.

ALOES IN THE NATIONAL BOTANIC GARDENS.

READERS of Dr. Pole-Evans' article on the African Aloes will be interested in the following list (compiled by Miss Doris Penfold) of the species of Aloe at present to be seen in cultivation at Kirstenbosch:—

Aloe africana
" *arborescens*
" *arborescens var. natalensis*
" *aristata*
" *Barberae*
" *brevifolia*
" *Boylei*
" *Broomii*
" *Brownii*
" *chortolirioides*
" *ciliaris*
" *commixta*
" *comosa*
" *Cooperi*
" *Davyana*
" *dichotoma*
" *distans*
Aloe macracantha
" *melanacantha*
" *micracantha*
" *micrantha*
" *microstigma*
" *mitraeformis*
" *natalensis*
" *parvibracteata*
" *Peglerae*
" *petricola*
" *plicatilis*
" *pluridens*
" *pratensis*
" *pretoriensis*
" *rubrolutea*
" *Salmdyckiana*
" *saponaria*
" *saponaria* × *striata*.
Aloe Dyeri
" *Ecklonis*
" *ferox*
" *ferox var.*
" *grandidentata*
" *Greenii*
" *hereroensis*
" *humilis*
" *Krapohliana*
" *Kraussii*
" *latifolia*
" *lineata*
" *longistyla*
Aloe speciosa
" *stans*
" *striata*
" *striatula*
" *succotrina*
" *supralaevis*
" *Thraskii*
" *variegata*
" *zebrina*

For these 56 species we are very largely indebted to the generosity of our correspondents all over South Africa. We very greatly hope that similar generosity will enable us to add to this collection the missing species mentioned in Dr. Pole-Evans' article; and readers who live in or visit any of the districts named are specially requested to help Kirstenbosch in this way.

R. H. C.

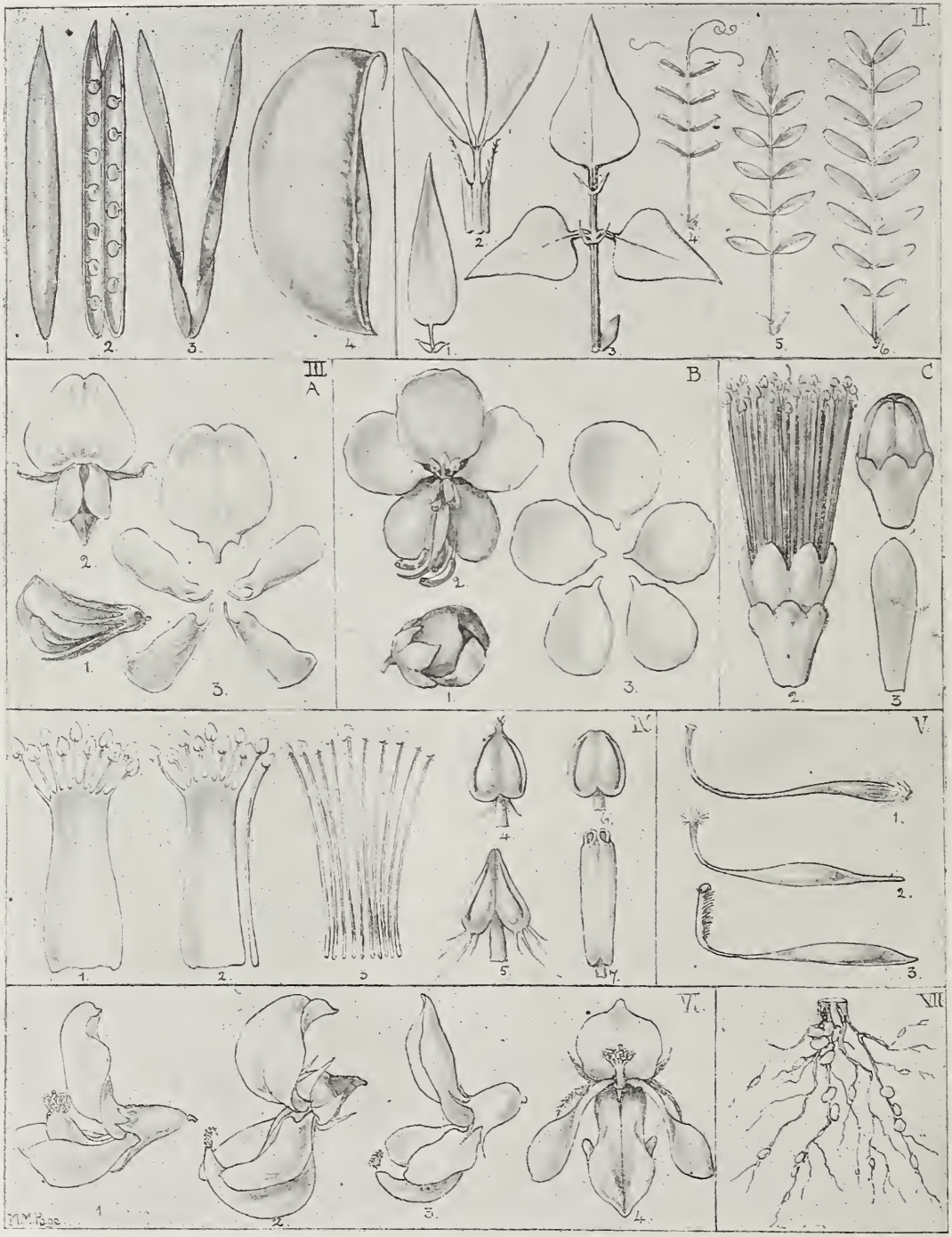


PLATE IV.

Leguminosae.

NOTES ON KIRSTENBOSCH LEGUMINOSAE.

AMONG the flowers native to Kirstenbosch the Leguminosae play a prominent part, not only from the point of view of beauty, but also of the number of species, and the number of individuals of each species.

Some striking member of the Order appears at each season of the year, staying well on into the next to reach the height of its glory. Spring comes with a gay troop of yellow blossoms to warm the Summer—the golden yellow honey-tea (*Cyclopia genistoides*), orange nodding head (*Liparia sphaerica*), the large and grey-leaved *Rafnia triflora*, and the two tall finer-leaved species of Aspalathus (*A. macrantha* and *A. Willdenoviana*). In summer the keur (*Virgilia capensis*), with its sweet-scented, pale pink flowers, reigns supreme. How the breezes play over the silver-backed leaves, and come to you laden with fragrance! And how the bees buzz over their honey-getting! Autumn finds the rose-pink *Indigofera cytisoides*, with its large bracts guarding the buds from winter's rain and ready to fall as the flower swells, while winter itself gives the lovely keurtje (*Podalyria calyptrata*) to be the pink dawn of spring. All over, among the other wild shrubs, one sees the loose clusters of its large blossoms, and high up the slope it stretches, for each year it is increasing, because now it is guarded in those fastnesses from the thoughtless destroyers of beauty.

Ranging in habit from the delicate annual vetches and clovers to tall shrubs and trees, the Leguminosae present many forms of growth, and a day's ramble in summer over the Kirstenbosch wilds will yield a series of varied delights. Peeping through the herbage at one's feet one may find the lowly yellow *Rhynchosia glandulosa* and *Argyrolobium lanceolatum*, the deep pink *Tephrosia capensis*, the wine-coloured *Hallia cordata*, and where the ground is roughest sprawl the long flowery branches of *Aspalathus retroflexa*. Scrambling over bushes, with long arms waving above ready to twine round the first support that comes handy, is the sticky yellow-flowered *Fagelia bituminosa*, with its strong tarry smell. On the outskirts of the forest over the taller shrubs and smaller trees scrambles and twines the purple-pink *Dolichos gibbosus*. Bristling at every leaf-tip with a minute but malignant spine is the bushy *Aspalathus astroites*, which comes up in masses after burning, and is handsome enough to look upon, but otherwise to be avoided. Too slender to stand alone, but leaning with so lightsome a touch, the dainty *Indigofera filiformis* is scarcely ever out of flower; while her water-loving sister, *I. filifolia*, hides in among reeds and rushes, pretending to be one of them. For more often than not she never lets her leaflets grow at all, so that, if it were not for her bright magenta-pink flowers, she might pass for one of her neighbour's family. Also loving the gently-flowing streams, the blue-flowered *Psoralea pinnata* with feathery foliage, sometimes reaches a height of ten feet, and is a beautiful sight in full bloom. On the slopes, almost startling one by the brilliant scarlet of its flowers, is *Sutherlandia frutescens*, the cancer-bush, which may prove in time to come to be valuable as a cure for cancer. The large, conspicuous, inflated, papery pods do not shed their seeds, like most other members of this Order, while still on the plant, but fall unopened to be blown abroad, so that thus the seeds may be finally dispersed.

The Leguminosae are the second largest Order of flowering-plants in the world, and comprise many of our beautiful garden-plants—Laburnum, Wistaria, sweet-pea. South Africa, too, may lay claim to some of the most striking examples—the gorgeous red-blossomed Kaffir-boom (*Erythrina caffra*), the soft blue "African Wistaria" (*Bolusanthus speciosus*), and the glowing "Pride of the Kaap" (*Bauhinia Galpinii*), which, when in its full glory, is said to be so overwhelmingly beautiful as to be a sight for gods rather than men!

Except Bauhinia, these as well as all the Kirsten-

EXPLANATION OF PLATE.

1. LEGUMES.—Fig. 1, legume of *Indigofera;* 2, do., laid open; 3, do. after shedding of seeds; 4, inflated legume of *Sutherlandia.*
2. LEAVES.—Fig. 1, simple leaf of *Hallia;* 2, digitately 3-foliate leaf of *Trifolium;* 3, pinnately 3-foliate leaf of *Dolichos*, shewing stipellæ; 4, pinnately compound leaf of *Vicia*, shewing end leaflets as tendrils; 5, impari-pinnately compound leaf of *Indigofera;* 6, pari-pinnately compound leaf of *Acacia.*
3. FLOWERS.—A. *Papilionata*: Fig. 1, bud; 2, flower; 3, petals. B. *Caesalpinioidea*: Fig. 1, bud; 2, flower; 3, petals. C. *Mimosoidea*: Fig. 1, bud; 2, flower; 3, petal.
4. ANDROECIUM.—Fig. 1, monadelphous stamens; 2, diadelphous do.; 3, separate stamens; 4, 5, 6, anthers showing dehiscence by slits; 7, do. by pores.
5. GYNAECEUM.—Fig. 1, glabrous style and simple stigma of Indigofera; 2, brush-stigma and stipulate ovary of *Aspalathus;* 3, bearded style of *Dolichos.*
6. POLLEN-MECHANISM.—Fig. 1, *Psoralea*, where the stamens and stigma emerge and return again; 2, *Crotalaria*, piston-mechanism where the pollen is squeezed out in small quantities; 3, *Aspalathus macrantha*, where the stigma presents pollen; 4, *Indigofera*, explosion-mechanism.
7. Roots with "tubercles" containing bacteria.

bosch species belong to the group known as the Papilionatae, characterized by the "butterfly" corolla, while a second group, Mimosoideae, includes all the acacias, and the third group, Caesalpinioideae, the cassias and Rhodesian mahogany-tree (*Afzelia cuanzensis*), less known from its queer flower than its sturdy "mahogany-bean," whose black and red seeds are used as ornaments.

All these groups have the fruit characteristic of the Order, viz., the legume, formed of a solitary carpel, with the seeds arranged down one side only. It is according to the shape of the corolla and the way the petals are arranged in the bud that the three groups are constituted.

In the Papilionatae the corolla is showy, the upper petals fold over the lower in the bud, and the ten stamens are well protected beneath the two front petals that form the keel. In the acacias, however, the petals are small and regular and merely touch, without overlapping, in the bud, while the stamens are unconcealed and numerous, forming the really showy part of the flower. The stamens of the Caesalpinioideae never exceed ten, and the petals of each flower are not very unlike one another in size and shape. Moreover, the lower petals, in this group, overlap the upper ones.

Probably many of the short-tongued insects are to be included among the visitors to the two latter groups, but, as the Papilionatae have their honey as well as their stamens concealed, the clever bees are the chief insects that visit them The stamens are usually united at the base, and so help to contain the honey, except the one stamen opposite the standard, which is generally free to allow an opening, on each side of itself, to the honey within the tube. The bee alights on the wings which fit over the keel, and the pressure she exerts, as she probes, causes the keel to give way and to expose the stigma and pollen. Sometimes one pressure causes the wings and keel to fly apart, and the style and stamens to come up with a sudden jerk, scattering a puff of pollen in the movement. This is known as the "explosive" method, and occurs in Indigofera. Far more commonly the stigma and stamens are exposed at each pressure, and then retire within the keel, so that the pollen is kept in reserve for repeated visits—as in Fagelia, Trifolium, Hallia and others. The stigma usually comes first, and has, therefore, a good chance of being cross-pollinated. A third method is known as the "piston-mechanism," where pollen is squeezed in small quantities out of the tip of the keel—as in Crotalaria. In some cases the style has a brush of hairs which sweeps up the pollen, and presents it in small quantities to the visitor—as in *Aspalathus macrantha*.

Liparia differs from the great majority of the Papilionatae in that it is ornithophilous, *i.e.*, pollinated by birds, no doubt the sugar-birds. The wings are wound so tightly round the keel that they could not afford an alighting-place, and, as the flowers hang down, the bird would give the appearance of raising these petals, whether it bent over them or ducked under them, to probe.

The most usual method of dispersing the seed is for the legume to split down both edges, and for each portion to curl in a spiral, thus ensuring that the seeds get something of a send-off—as in Dolichos, Rafnia, Indigofera and others. Some legumes, like the light papery ones of Sutherlandia and Lessertia, and those provided with hooks for attachment to animals, as in Medicago, only dehisce after they have become severed from the parent plant. Others break up into one-seeded portions, while, still more rarely, some one-seeded legumes, often provided with a wing, do not dehisce at all. *Arachis hypogaea*, the pea- or monkey-nut, sows its own fruit. "The flower after fertilization bends downwards, and the elongation of its stalk forces the young pod underground, where it ripens." From this characteristic it derives its name of earth- or ground-nut.

The roots of most species of Leguminosae are provided with small tubercles containing peculiar bacteria, which enable the plant to absorb nitrogen from the air. This no plant unprovided with these tubercles can do. The plant is able to consume these bacteria after they have stored up a considerable amount of nitrogen. From this can be seen the great value of Leguminosae as a crop on poor soil, since they enrich it by liberating the nitrogen on the decay of their roots.

The leaves of the Leguminosae are usually alternate, and most of them have stipules. In some cases the stipules are early deciduous, and can only be found among the younger leaves—as in Podalyria and Virgilia; in others they persist throughout—as in Trifolium and Lotononis. The leaves themselves are sometimes simple—as in Liparia, Rafnia, and Podalyria—but much more often they are divided into leaflets and are called compound. When all the leaflets spring from the tip of the petiole the leaf is said to be palmately compound, and when the leaflets are in pairs, with or without an odd one at the end, it is known as pinnately compound.

Of the 30 genera recorded from the Cape Peninsula, 21 have been found wild at Kirstenbosch, represented by some 45 species. The following is an attempt at a key for determining, in the field, the genus of a Leguminosa found in wild parts of Kirstenbosch.

Leaves simple.
 Leaves stipulate.
 Shrubby; fls. large, pink *Podalyria.*
 Herbaceous; fls. very small, purplish wine-coloured *Hallia.*
 Leaves exstipulate.
 Leaves 1-6in. or more broad.
 Leaves glabrous.
 Fls. 1 in. or more long, in large roundish clusters *Liparia.*
 Fls. about ½ in. or less long, in small clusters
 Leaves yellowish green, rigid and spine-tipped*Borbonia.*
 Leaves greyish green, not rigid nor spine-tipped *Rafnia.*
 Leaves silvery, silky *Priestleya.*
 Leaves less than 1/6 in. broad *Aspalathus.*

Leaves compound.
Pollen-mechanism explosive *Indigofera.*
Pollen-mechanism not explosive.
Leaflets 3 or reduced to fewer.
Twining plants.
Fls. yellow.
Plant rather sticky and strong-smelling *Fagelia.*
Plant not as above *Rhynchosia.*
Fls. purplish pink *Dolichos.*
Not twining.
Leaves stipulate.
Fls. yellow.
Stipules stalked *Crotalaria.*
Stipules not stalked.
Margins of the leaflets finely serrate.
Fls. in dense spikes or heads *Trifolium.*
Fls. not as above *Medicago.*
Margins of the leaflets entire *Lotononis.*
Fls. not yellow *Psoralea.*
Leaves exstipulate
Leaves glabrous *Cyclopia.*
Leaves hairy *Aspalathus.*
Leaflets more than three.
Climbing by tendrils *Vicia.*
Not as above.
Fls. blue *Psoralea.*
Fls. not blue.
Trees *Virgilia.*
Not trees.
Fls. bright scarlet, 1 in. or more long *Sutherlandia.*
Fls. not bright scarlet, less than ½ in. long.
Leaves blunt at apex; fls. purplish wine-coloured. *Lessertia.*
Leaves acute at apex; fls. bright dark pink .. *Tephrosia.*

M. Beghin.
L. Bolus.
V. Halm.

SOME RECENT PUBLICATIONS.

UNDER the title "Elementary Lessons in Systematic Botany" Mrs. Bolus has collected and adapted twenty-two articles which have appeared in the *S.A. Lady's Pictorial and Home Journal*, 1917-19, and has added an Introduction and Summaries to help in plant analysis and description. The lessons are arranged in progressive order of difficulty, and the types chosen are common and widely known South African plants; and all through the requirements of the beginner are kept in mind. The adaptations to insect and bird pollination are mentioned, and little rhymes on the different plants are introduced.

The illustrations are by Miss M. M. Page, with whose delicate and accurate work readers of this Journal are already familiar. The book may be recommended both to pupils and teachers, and also to any who wish to be led to a closer acquaintance with some of our native flowers. (Capetown: Maskew Miller. 7¼ × 4¾ ins.; pp. 96; figs. 24. Price 2s.)

* * *

Dr. J. C. Willis, who was Director of the Botanic Gardens at Peradeniya, Ceylon, and later at Rio de Janeiro, has just published through the Cambridge University Press a new edition of his "Flowering Plants and Ferns" (1919; 8vo., pp. xii + 712 + lv. English published price 20s.) The whole work now forms a complete dictionary, the Parts I and III of previous editions being largely incorporated in alphabetical order. In addition a great quantity of new matter has been added, so that all known genera are included together with an enormous amount of information about them. This has only been rendered possible by the copious use of abbreviations and cross-references. The book is now a model of a compendious work of reference, and is invaluable to all who are interested in the systematic study of plants as well as in their natural history and their geographical and economic aspects. It is an ideal book for use in a Botanic Garden.

* * *

Under the title "Flowering Trees and Shrubs for Use in South Africa" Dr. T. R. Sim has added one more volume to his valuable pioneer series of works on South African Botany, Gardening and Forestry (Johannesburg: Specialty Press, 1919; 8vo., pp. 200; 147 photographic and line illustrations. Post free 7s. 6d.).

In the first part are general instructions as to propagation and treatment, and useful lists are given of the species suitable for the vast range of conditions experienced in South Africa. The main part of the book consists of descriptions and cultural details of the exotic species of shrubs and trees which have been successfully cultivated in one part or another of this country. At the end are 40 pages on some of the trees and shrubs in which we are more specially interested at Kirstenbosch—those native to South Africa; and though, from the economic "unsentimental" point of view, Dr. Sim has recently poured scorn on our native forest trees (see his articles in the *S.A. Journal of Industries*, August, September, October, 1919), yet he is fully appreciative of the horticultural possibilities of some of our uniquely beautiful flowering shrubs and trees. It is one of the functions of Kirstenbosch to introduce the South African flora to South Africans, and to remove such a reproach as the (surely rather out-of-date) remark which Dr. Sim makes when, writing of Proteas, he says, "I have never seen one in cultivation in South Africa."

Dr. Sim's book will be welcomed by those laying out gardens, large or small, for arboreal species are a necessary framework of all.

* * *

Professor Thoday, of the University of Cape Town, has brought out a second edition of his "Botany: A Text-book for Senior Students" (Cambridge University Press; 8vo., pp. xx + 524; figs. 230; 1919. English published price, 7s. 6d.). This book provides one of the best groundings in general Botany which can be set before a student at the present day. The ideal of the book is the revelation of principles, whether they are the laws of growth, nutrition, etc., or the principles upon which the human mind deals with and arranges the vast masses of botanical details with which it is confronted. For instance, plant classification is shown, not as a meaningless tabulation, but as an expression of ideas of evolution. In dealing with plant structures, function is kept in view throughout.

Though written in the first instance for English readers, South Africans will find the greater part of the book readily adaptable to their own botanical environment.

* * *

The South African Journal of Industries for August, 1919, contains an article by the Curator of the National Botanic Gardens (Mr. J. W. Mathews) on "Economic Plants at Kirstenbosch," which summarizes the work done up to the present, which "has been possible only on account of the material being received as free donations. Present financial conditions do not allow of systematic and persistent efforts for the extension of economic work."

* * *

In that useful and attractive monthly, *South African Gardening and Country Life*, we often find notes and articles which are of interest to lovers of Kirstenbosch. This year, for instance, the August number contains a review of the Trustees' Annual Reports. "The most noticeable thing," says the writer, "is the amount of useful work which has been done in spite of the doers being crippled by lack of financial resources, and one is amazed at the apathy of the Government and general public towards what is in every sense one of the great national assets of the country." In March and May Miss Fairbridge publishes articles on "South African Herbs," and urges "all who have the opportunity to glean what knowledge they can before it dies out with the old coloured folk"; and in July the same author contributes an article on South African "Food Plants and those of Economic Value," and concludes that "We are only on the threshold of what may be accomplished by research and experiment in the medicinal, culinary, and economic plants of South Africa." Miss Fairbridge also has a valuable article on the history of Kirstenbosch in the January issue, and makes a special reference to the employment of women-gardeners there. "Could any profession be more interesting for a girl with health and strength and the desire to serve South Africa by studying and helping to develop its natural resources?"

Dr. Phillips has an article on "The Collecting and Preserving of Botanical Specimens" in the February number, in which clear instructions are given as to the way to make satisfactory herbarium sheets for private or public collections.

In the October issue we find an account by "Country Cousin" of a tramp to, around and from Kirstenbosch, with notes on some of the plants seen there. The author, like everyone else, is struck by the garden possibilities of our native Felicias, Gazanias, Dimorphothecas, etc. And yet "our horticulturists can sell any number of English daisies, but ask for either of the above plants and difficulties immediately arise."

FRONTISPIECE.

PANORAMA FROM THE KIRSTENBOSCH CONTOUR PATH.

The folding Frontispiece to this number is reproduced from a pen and ink drawing by Miss Mary M. Page, Botanical Artist to the Bolus Herbarium, University of Capetown. It represents the principal features in the marvellous view which is obtained from the Contour Path near its intersection with the Diamond Stream Path—a view extending from the Winterhoek Mountains to False Bay, and as varied in detail as it is magnificent in spaciousness and colour. There are mighty mountains and placid vleis, forests and sand-dunes, villages and vineyards; and sloping away below us lies Kirstenbosch, the precious national jewel set in a landscape unsurpassed the world over.

The naming of the various features was largely done by Miss Page; the Editor also wishes to acknowledge help in this kindly given by Mr. K. Cameron, of the Mountain Club, who is intimately acquainted as a climber with the majority of the mountains depicted. The altitudes of the principal peaks have been derived from the Mountain Club Annuals; some of them represent trigonometrical results, others aneroid readings only.

THE BOTANICAL SOCIETY OF SOUTH AFRICA.
ANNUAL REPORT, 1918.

IN issuing the Seventh Annual Report of the Society, the Council feel that they have every cause to congratulate the members that the steady progress which has attended the welfare of the Society in the past has been well maintained, having regard to the various calls for war purposes which have fallen upon all classes of the community. As will be seen from the details given later, there has been a substantial increase in the membership of the Society, enabling the grants to the National Botanic Gardens from ordinary Revenue to be substantially increased from £233 7s. 5d. in 1917 to £299 12s. 6d. in 1918. This increased grant has been deeply appreciated by the Trustees, and without it much of the more important work of the Gardens could not have been accomplished.

Four meetings of the Council have been held during the year. The annual gathering of the members at Kirstenbosch was held on Saturday, November 30th, and was well attended by members and their friends. The alteration of the date from February to November was acknowledged to be an improvement, the Gardens being in better condition at the latter time.

At the annual General Meeting the following were elected as members of the Executive Council for the year:—

Lady Rose-Innes, C.B.E.	Mr. Albert Walsh.
Mrs. Pearson.	Mr. C. F. Spilhaus.
Mrs. Carter, C.B.E.	Mr. A. H. Reid.
Miss Garlick.	Mr. W. A. Eaton.
Mrs. F. Bolus.	Mr. J. Storr Lister, I.S.O.
Miss Fairbridge.	Mr. Eustace Pillans, I.S.O.
Miss White.	Mr. W. de N. Lucas.
Mrs. Brown Lawrence.	Mr. H. T. Twentyman-Jones.
Mr. Justice Searle.	
Mr. Duncan Baxter.	Mr. F. E. Cartwright.

The Right Hon. Sir James Rose-Innes, K.C.M.G., was re-elected President; Sir Lionel Phillips, Bart., Sir Lewis Michell, K.C.V.O., and the Hon. W. P. Schreiner, Vice-Presidents.

The Council appointed Mr. W. Duncan Baxter, M.L.A., as Chairman; Mr. H. T. Twentyman Jones, Hon. Treasurer; and Mr. F. E. Cartwright, Hon. Secretary.

Obituary.—The Council have to record with regret the deaths of the following members: Mr. Eustace Pillans, I.S.O., who took a very active interest in the establishment of the Society; Mr. P. J. Marais, Dr. Hahn, Mr. J. Smits, Mr. Justice Hopley, Mr. E. E. Dower, Mr. L. Woodhead, M.L.A., Lieut. L. Walsh, M.C., D.C.M., of the London Regiment, who died on active service; Mrs. McGregor, and Mrs. J. Rawbone.

Journal.—The publication of the Society's journal for 1918 resulted in a most interesting number. The cost was slightly increased owing to higher price of paper and difficulties attending the printing trade, but the increased cost has been amply justified by the many calls that have been made for this journal. Arrangements will be made to continue the publication during the coming year. Thanks are due to those who wrote articles, thereby contributing to the Society's national usefulness and helping to maintain its standing among the practical and scientific institutions of South Africa.

The total membership of the Society now stands at: Life members 49, Ordinary members 281, Associate members 78, Family members 49, showing nett increase during the year of 4 life members, 4 family members, 53 ordinary members, 30 associate members.

The work of developing Kirstenbosch is proceeding steadily, and various new features have been undertaken during the year. Lack of labour and of an adequate income have been heavy handicaps to the work, and the assistance given by the Botanical Society, both from current revenue and the Life Members' Fund, towards the cost of the completion of the Fern Dell has been invaluable. The more the work proceeds of developing Kirstenbosch, the more evident it becomes how successful and national a work it can be made if only those in charge of it are given the means of doing the work. The experiments in the Economic Garden alone justify the much fuller development of this portion of the work, but without an adequate income it will be impossible to make Kirstenbosch what it might and ought to be, or to achieve the scientific and economic results which lie within its reach. The support given by the Government still stands at £750, to which figure it was reduced from £1,000 in 1914 as a war measure, and the Trustees have become more and more dependent upon the sale of wood and acorns, and upon grants from this Society, to keep the Gardens going. Revenue from the first-named source will gradually disappear at no distant date with the exhaustion of surplus trees, and £750 from Government is surely a poor recognition and support of a work of national character. The Society can do a great deal to ease the difficulties of the position by an increase in its membership.

It is gratifying to report that Professor R. H. Compton, M.A., the newly-appointed Director of the National Botanic Gardens, has arrived from England, and taken over the work at Kirstenbosch.

The Council desire to thank the City Corporation for the use of the Library and other rooms for the holding of their meetings, also to the Press for their invaluable assistance in reporting and calling attention to the work of the Society.

The financial statement, as passed by the auditors, is attached.

W. DUNCAN BAXTER,
Chairman of Council.

FRANK CARTWRIGHT,
Hon. Secretary.

CAPE TOWN,
1st April, 1919.

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The Botanical Society of South Africa.

OBJECTS:

(*a*) To encourage the inhabitants of South Africa to take an active part in the progress and development of the National Botanic Gardens at Kirstenbosch, a part of the Groote Schuur Estate, in the Cape Province, and to induce them to appreciate their responsibilities therein.

(*b*) To augment the Government grants towards developing, improving, and maintaining fully equipped botanical gardens, laboratories, experimental gardens, etc., at Kirstenbosch.

(*c*) To organize shows at which may be displayed the results of botanical experiments or cultural skill in improving the different varieties of South African flora.

(*d*) To enlighten and instruct the members on botanical subjects by means of meetings, lectures, and conferences, and by the distribution of literature.

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Edited by R. H. COMPTON, M.A.,
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The Journal of the Botanical Society of South Africa.

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NOTES AND NEWS.

The Membership of the Botanical Society shows a continued increase. A very satisfactory feature is the increasing interest in Kirstenbosch as a National institution, which is being shown by people in parts of the Union and Rhodesia other than in the immediate vicinity of the Gardens. The following figures show the growth of membership of the Society since its foundation:—

	Life.	*Family.*	*Ordinary.*	*Associate.*	*Total.*
1914	33	22	264	33	352
1915	46	26	263	32	367
1916	49	26	264	45	384
1917	46	24	249	53	362
1918	49	28	281	78	436
1919	50	38	320	84	492
Present Date	53	44	389	168	654

Kirstenbosch is a growing child, seven years old, kept desperately short of pocket-money by a paternal Government: it is fortunate indeed that there are so many kind uncles and aunts, in the shape of Members of the Botanical Society, to contribute to the child's upbringing and to set an example of enlightened generosity in other quarters.

* * *

During the year the Gardens have been visited by the Prime Minister, the Minister of the Interior and, on the 1st May, by a party of about seventy Senators and Members of the Legislative Assembly. On 30th October Mrs. Burton entertained the delegates to the Women's South African Party Congress at Kirstenbosch, there being an attendance of over 200. The Mountain Club of South Africa held one of its Natural History Rambles at Kirstenbosch on 30th October.

* * *

The Council of the Botanical Society has authorised the holding of a number (about three in the year) of informal gatherings of Members and Associates at Kirstenbosch with a view to keeping them in touch with the work and progress of the Gardens. Dates will be announced in the Press.

* * *

The Botany Rambles instituted by the Society last January have been continued throughout the year, and thanks are due to the Secretary (Mrs. Bolus) for conducting them. It is gratifying to know that Kirstenbosch has been able to provide ample material to cover the syllabus set for Matriculation Botany, and that it has made it possible to give students the opportunity of doing all their work, except such as must of necessity be done in the laboratory, among the living growing plants. The Rambles for this year closed on November 20th, but will be resumed next February. It is hoped that teachers will make an effort to bring their students on a school-day instead of on a Saturday, when, owing to Sabbath observances and matches, the whole class is unable to attend.

In connection with the Botany Rambles it should be noted that the Society is publishing in its Journal an account of the Families set for Matriculation, together with plates, prepared at the Bolus Herbarium, giving details of structure; and it would urge teachers, by joining the Society, to acquire copies of the Journal for use in the class-room. So far the Families dealt with are the Ericaceae, Leguminosae and Compositae.

* * *

Under the auspices of the Society four courses of one week's duration have been held at Kirstenbosch during the year. These were also conducted by the Secretary, and were much appreciated by the teachers and student-teachers who attended them. In connection with these courses the accommodation of the Temporary Hostel has been strained to the utmost, and thanks are due to the Acting Lady Warden (Miss N. de Jager) for the ability and energy she has devoted to the task.

* * *

The National Botanic Gardens has recently been enriched by the gift of a sundial. The donor is Dr. J. Halm, of the Royal Observatory, and the dial, which was made and engraved to his design by Mr. T. R. Miller, is a beautiful piece of work. It is a circular brass plate and style, sand-plastered and gilt. In addition to the usual figures showing the hours, there is a special device by which the South African time can be calculated from the true time as shown by the shadow. To many people it may be a surprise that gun-time is sometimes ahead of, sometimes behind, sun-time. A series of figures indicating the differences at different times of the year is engraved on the margin of the dial, and by taking the hour-figures to represent months the gun-time can be found by simply adding or subtracting the number of minutes shown in the margin from the time indicated by the shadow.

The dial is situated in the middle of the Terrace at the head of the Great Lawn. It is mounted on a naturally weathered boulder of hard Table Mountain sandstone, which was brought from behind the Aloe Kopje, and erected for the purpose: the block weighed nearly three tons, and though moved entirely by hand, it arrived with some of the original moss still growing on it. On the face of the block, under a rising sun, is the motto, in Latin, composed by Dr. Halm, on the basis of a suggestion by Professor Ritchie:—

HORAS SIGNO
UMBRA MOVENTE
FLORES GIGNO
LUCE FOVENTE,

this being not only appropriate but following the best tradition of sundial "posies." On the north side is the inscription INVENIT ET DEDIT J. HALM,

PH.D.: and on the south side is a small brass plate explaining the method of calculating standard from solar time. The pedestal is surrounded by a low circular cobbled platform.

* * *

A small hexagonal rustic shelter, built of gum-poles, fir-spars and thatch, has been erected at the Entrance Gates of the Gardens. This serves for the display of notices and as a protection for the guard on duty in rainy weather.

* * *

The Provincial authorities have completed and opened for traffic a new road providing a shorter route from Claremont and Kenilworth to Kirstenbosch. This leads from Protea Road near the end of Mountain Road, crosses the Liesbeek by a new bridge and enters Rhodes Avenue between the Kirstenbosch Workmen's Cottages and Protea Church.

* * *

By the death of William Tyson last April South Africa loses one of the most indefatigable of her recent botanical collectors. His most extensive collections of flowering plants were made in Griqualand East and Pondoland. After the disposal of his herbarium to the Cape Government Herbarium in 1892, he devoted himself for many years to the marine algae, mainly for the British Museum: his choice of Port Alfred as a home some ten years ago being largely determined by the richness of the seaweed vegetation in that neighbourhood. Recent volumes of the Flora Capensis bear testimony to the large extent and value of his collection. His name is commemorated in many of his newly discovered species and in the Boraginaccous genus Tysonia.

* * *

We also regret to record the death of Mrs. Edwin Goldman, to whom the Botanical Society owes the "Bird's Eye View of Kirstenbosch" in Part IV (1918) of this JOURNAL.

* * *

All lovers of Nature will rejoice with Mgr. Kolbe in the recovery of his sight, as the result of an operation. He writes to Mrs. Bolus "You'll be so glad to hear that the flowers and stars are mine again."

* * *

In the Kew Bulletin No. 5, 1920, we find an account by Mr. A. W. Hill of the Tresco Abbey Gardens in the Scilly Isles. These small islands off the coast of Cornwall enjoy a climate similar to that of the South-West Cape, and many of our native plants flourish there as they do in no other part of Great Britain. Mesembryanthema and Pelargonia grow with vigour: *P. tomentosum* even kills out the common bramble by suffocation. There are many fine Aloes and Crassulas: *Halleria lucida* grows 30 feet high: and some of our Oxalis are ineradicable weeds. Many of these South African plants were sent to Tresco by Major A. A. Dorrien-Smith, the present owner, during his service in the South African War. Mr. H. J. Elwes writes: "When at Scilly lately I found a great many species of Mesembryanthemum which seem to hybridize freely and become naturalised on the rocks there, where Agapanthus also with *Crassula coccinea* and other South African plants have become perfect weeds.

* * *

On Wiener's Day, October 4th, 1920, a record number of persons visited Kirstenbosch. No fewer than 989 were counted at the gates, of whom the great majority came on foot. It is clear that when better means of access are available the number of visitors on public holidays will run into thousands.

* * *

A small exhibit of Proteaceae cultivated in the National Botanic Gardens was on show at the Visitors' Bureau in Lower Adderley Street in August. The Secretary of the Publicity Association estimates that about 3,000 people came to see this exhibit, which was only advertised by a notice board outside the Bureau and an announcement in the Press.

* * *

The Hon. Secretary of the Botanical Society has a number of copies of Parts I. and II. of this Journal, which are available to Members on application.

* * *

Will Members and Associates who have changed their addresses kindly inform the Hon. Secretary, in order to ensure the receipt of the Journal and other publications. The Hon. Secretary would also be glad to receive corrections of any errors or misdescriptions which may unfortunately occur in the Membership Roll. (pp. 18-20.)

* * *

The climate of Kirstenbosch this year has been one of extremes. During the hot months of January, February, and March less than one inch of rain fell in all. Even the Nursery Stream (on which residents depend for their water-supply and the Gardens in part for their hosing) perilously approached extinction: the spring that rises in the Bath, however, flowed regularly and almost undiminished in volume, and kept the Fern Dell one of the pleasantest spots in the Peninsula.

The winter, on the other hand, has been the wettest and most stormy on record, and a considerable amount of damage was done in the Gardens by the violent north-westerly gales. (A noteworthy fact was that most of the trees brought down by these gales fell *towards* the north-west and not, as might have been expected, in the opposite direction). The total rainfall for the five months May-September was no less than 58.61 inches: June being the wettest month, with 17.31 inches. The records show that the week-ends were wetter than the mid-weeks! Two week-ends in May were responsible for 4.66 and 3.97 inches, one in June had 5.03 inches, one in August 4.85, and one in September 3.29. During these five months rain fell on 69 days, 84 being rainless.

The temperature reached a maximum on the 16th of February with 91°.8 F. and a minimum on 24th May, with 40° F.

We call the attention of our readers to the Wild Flower Protection Society which has recently been founded to extend the scope and activities of the old Wild Flower Protection Committee. All lovers of the South African flora must sympathise with the object of the Society, which is "to preserve the native plants of South Africa in their natural surroundings." With this purpose the Society aims at the following:

1. To inculcate among South Africans a love and respect for their heritage of wild flowers and a sense of their duty to hand on this heritage unspoiled to posterity.
2. To educate children and others in an appreciation of our flowers as they grow in the wild state.
3. To encourage the cultivation of our native plants as an alternative to the gathering of wild flowers for sale or ornament.
4. To give assistance to Government in all matters bearing on the protection of wild flowers and to suggest forward legislative measures.
5. To organise publicity of all kinds.

Membership of the Society is obtained by the payment of an annual subscription of not less than five shillings.

The Hon. Secretary is Mrs. Bolus, University of Cape Town.

Articles will be found in this JOURNAL on the subject of Wild Flower Protection. We strongly urge our readers to support the work of the new Society in every possible way.

VARIATIONS.

THE richness of the South African Flora is recognised as surpassing that of any other country. And as the collections at Kirstenbosch increase in numbers and become established it is seen there is a still more wonderful variation in numerous genera, and even within the species, than has been recorded previously.

Among the Daisies or Composites that have flowered in the last year or two are various genera showing a wide range in their colour forms. In a mass of *Ursinia chrysanthemoides* now flowering, some plants are producing flowers of a deep orange, and others flowers of a sulphur colour. Is this change complete, or will it continue until we have a range of colour as in many florist's flowers, as has taken place naturally in *Arctotis acaulis,* and to a lesser extent in *Arctotis aspera?*

The variation in colour is readily understandable to the hybridist, as the results are to all appearances similar to what have been achieved under artificial cross-pollination. The derivation of many of the florist's strains of garden flowers is attributed in most cases to one species of the particular flower.

One of the most recent instances of colour variation under cultivation is that of *Dimorphotheca aurantiaca,* and the results in this case accord with those above. I have not heard or seen that any other species was used in its production, nor do the forms suggest the use or influence of another species.

How then was the first variation brought about? Was a disturbance of the factors created by foreign pollen? Or was it induced in the individual by its changed conditions? One or the other must have taken place or how could such varied strains be obtained, each from a particular species? Was the first step in the evolution of these strains a natural mutation followed by hybridisation between the original species and its mutant?

Of recent years, when new hybrids are artificially produced the parentage is often given by the raiser, as in the case of the coloured strain of Freesias. These are admittedly derived from the cross-pollination of *Freesia Armstrongi* and *F. refracta,* and characters of both parents are seen in the progeny. In what way then do these differ from the aforementioned strains? Their origin would appear to be in quite different processes.

Quite recently there was brought to my notice by one of the coloured men "a different sort of Silver Tree," as he put it. On inspection it was found to be a tree about thirty feet high with foliage, colouring of twigs, etc., as in *Leucadendron plumosum,* but larger in all its parts. The old cones (the tree is a female) contain apparently fully matured seeds. Search failed to find any male plants around. One young plant, about eighteen inches high, only could be found in the immediate neighbourhood. It is identical in its vegetative characters with the old plant.

How has this individual arisen? There are no *Leucadendron plumosum* in the vicinity. Is the old tree a natural hybrid between *Leucadendron argenteum* and *L. plumosum,* with the stature of the former and the foliage of the latter? Or shall we have to turn to the mutation theory of De Vries for an explanation of its origin, and find in this the "Origin of Species?" If not, whence came the supposedly essential pollination to produce the young offspring which is an exact counterpart of the female parent. If a hybrid, will future generations break up in the now orthodox Mendelian way, or will the constant infusion of the Silver Tree immediately or gradually dominate the less vigorous element of *L. plumosum?* Or have we here, not only a solution of the "Origin of Species," but also a striking example of parthenogenesis? By a combination of mutation and parthenogenesis we should have a distinct but fixed species. By Mendelism alone we should have an individual capable of infinite development.

We have therefore what would appear to be three more or less distinct processes at work amongst plants tending to produce an increase of distinct individuals. Firstly, that resulting mainly in colour variation, as

exemplified in Dimorphotheca varieties. Secondly, that of Mendelism or the fusion of two species, as in the Freesias. Thirdly, that of De Vries' mutation, as it would seem in the Leucadendron. Just how much these three processes are interdependent does not yet seem clear.

Under natural conditions there seems little evidence that plants are hybridised other than in the process resulting mainly in floral variations, and then only very occasionally, and confined to a few genera mainly in Compositae. Under artificial pollination between two species or varieties there would sooner or later take place all three processes, as is evidenced in the evolution of the modern Sweet Peas, in which, now and then, at widely different times and places, have been thrown off individuals differing greatly from their immediate relations, and which in their turn give rise to new strains, as in Cupid Sweet Peas, Early Flowering, etc.

J. W. Mathews.

STAPELIEAE.

THE large and widely distributed natural order of plants known as Asclepiadaceae is divided up into several tribes. To one of these the name Stapelieae has been given, since the oldest and largest of its genera is Stapelia. Other genera of the tribe represented in South Africa are Pectinaria, Trichocaulon, Hoodia, Tavaresia, Diplocyatha, Caralluma, Duvalia, Piaranthus, Huernia and Huerniopsis. All plants included in the tribe are popularly termed Stapelias. This group of succulents is not confined to South Africa, where the species and individuals are most numerous, but is also represented by a few species in Tropical and North Africa, one at Malta and Gibraltar and several in Arabia and India. Together they number about 250. Stapelia claims at least 70 species.

In all cases the plants are perennial (except when the kind grower is too liberal with food and water), and most are dwarf in habit, being less than a foot high. The dwarf type usually have their stems crowded, branched at the base and four-to-six-sided, bearing short spines or rudimentary leaves on their toothed angles. Such stems produce the flowers from their base or in the channels between the angles. The taller-growing type mostly have Cactus-like stems, with many vertical spiny angles or tubercles, and the plants are supported by one main stem in the ground. Their flowers are very numerous, appearing round the apex of the stems. Two or more species in as many genera may have stems almost identical, so that it is not always possible to determine the genus of a plant without flowers. And in some genera the stems vary but slightly through many species. Yet in the flowers there appear such ranges of colour and form as to afford easy means of differentiation. *Caralluma hottentotorum* bears flowers of the smallest size, a quarter-of-an-inch in diameter. *Stapelia gigantea* manages to develop the largest of the flowers, 12—16 inches in diameter. Stapelieae flowers may be tubular, cup- or saucer-shaped. The petals or lobes are normally five, erect, spreading or curled under the basal part of the flower. In the genus Pectinaria they remain joined at the tips. Many species have vibratile hairs on the margins of the lobes. These hairs quickly move from side to side upon the slightest movement of air. The inner surface of the flowers may be smooth and shiny, rough with papillae, groved or with fleshy ridges, velvety or densely covered with long woolly hairs. Colouration of flowers varies from white through cream, yellow, green, claret, purple-brown and chocolate to black, with many combinations of these. Almost all the flowers are more or less scented of carrion, or else they suggest bad fish and similar pungent odours. But their beauties of form and colour more than compensate for any little unpleasantness.

There are but few districts in South Africa which have not at least one of the Stapelieae as a native plant. The greatest number of species and individuals inhabit that narrow belt of country known as the Little Karroo, which lies between the South-Western Districts and the Great Karroo. In Namaqualand there is a great variety, but, so far as we know, the individuals are less abundant than on the Karroo. Only the three genera Stapelia, Caralluma and Duvalia appear in the South-Western Districts. Stapelia is represented by the species *S. variegata* and *S. hirsuta*. The first of these is mainly a coast plant, being plentiful in several localities on the Cape Peninsula and even on Robben Island. On the Great Karroo the species are fewer than in Namaqualand and the individuals more evenly dispersed. In the Midlands of the Cape Province and in the Kalahari Region Stapelieae are markedly confined to certain spots where the conditions are favourable. This is natural in regions with dense grass or bush. Natal has fewer species than any other province, the grass and bush not being favourable. But Natal can boast of having the largest flowered species, *S. gigantea*, a hardy plant growing on the Drakensberg. The Transvaal with its grass and bush offers few inducements for these plants to live there. An exception must be made for the western edge of the Province where conditions are more karroid. Some striking plants have in recent years been found in this area. Little is known of the Bechuanaland Stapelieae, but the nature of that country is such as to promise a rich field for the collector. Many remarkable finds have been made in the South-West Africa Protectorate, where the distribution and character of the plants seem to resemble those of Namaqualand. It is assuredly a region worth careful searching.

The collector will soon notice that most Stapelieae in the wild state grow on a western- or north-western aspect. They are frequently on a northern aspect, but only in exceptional circumstances will any be found on a slope facing south. The majority prefer to be shaded from part of the day's sunshine; this shade they usually obtain by growing under or at the side of a low bush. Here they thrive best, in the light soil which has accumulated through the action of wind and water. It is in such situations that plants of the dwarf type are chiefly found. Robust species of Caralluma and Stapelia and all the Hoodias and Trichocaulons revel in full exposure to the sun.

Stapelia variegata was the first of the South African Stapelieae to be discovered. It was taken to Holland about 1640. *Stapelia hirsuta* was next introduced into cultivation. Plants were taken to Europe at the end of the 17th Century. These two hardy species were the only South African members of the tribe cultivated in Europe until 1774. During the period 1774—1795 Francis Masson collected and sent to Kew about 40 species from the Cape Province and Namaqualand. Then a considerable time elapsed in which only a few new species were collected. While Sir Henry Barkly was Governor at the Cape, from 1873 to 1877, he and his family took a great interest in these remarkable plants. Not only did the Governor himself search for them and enlist the assistance of friends and officials but he also grew a large collection at Government House, Cape Town. As the flowers appeared they were drawn by Lady Barkly. From that time to the present the fascination of Stapelieae has induced many persons to collect and grow them, and the number of species within the knowledge of science has about doubled.

The following remarks regarding cultivation are based on a long experience with Stapelieae on the Cape Peninsula. It is probable that in places where the summers are wet and the winters dry, some changes in method will be advisable. During the late summer or early winter, while the plants are resting, is the best time for collecting them. At that stage they will suffer least in transit and will usually start into growth soon after being planted and watered. Whenever possible rooted pieces of stem should be collected or, when there is only a single stem in the ground, the whole plant should be taken. In the genera Hoodia and Trichocaulon and with some species of Caralluma it is impossible or, in a few cases, only with the greatest difficulty that stems can be induced to root. Stapelieae have always succeeded best in these parts when grown in flower pots, provided they received proper treatment. Drainage should be ample, pieces of broken pots answering best. A coarse but light soil having mixed with it a small proportion of pebbles should fill a third of the pot, the remaining space, up to half-an-inch of the rim, being occupied by a sandy porous soil which will not cake. Their roots must have air. A sweet soil, preferably one containing a little lime or plaster rubble, is favoured by all Stapelieae. Sourness of soil encourages fungi, the chief enemies of most succulents when taken to the coast. Care is needed, when planting, not to bury the base of the stems deeper than they stood before; and the watering required is very slight until the plants are freshly rooted. During summer the potted plants will need only half a day's sun, in such a position as on the eastern side of a hedge or wall. Apply water only when the stems show signs of wilting in a growing plant or when a healthy plant is backward in its growth. From mid-summer to early winter the flowers appear. When the flowers are over the supply of water should be gradually reduced so as to prepare the plant for its winter rest. Before heavy rains set in place the plants in an airy and light shelter where they can be kept quite dry. In the case of a small collection the pots may be laid on their sides upon an outer windowsill where the winter sun will reach them. About the end of August some plants will commence to grow. Repot these with fresh soil, first scraping the pots clean. Supply a little water and keep these plants under shelter until the warm days of spring arrive. By that time all Stapelieae should have been repotted. Throughout the year it is wise to watch for any traces of rot and to remove the affected parts.

The genus Stapelia provides the hardiest plants with the most varied and attractive flowers. Four large-flowered and hardy species easily procured from collectors are *S. gigantea, S. nobilis, S. Leendertziae* and *S. flavirostris.* Others with flowers of lesser size and beautiful colouring are *S. Gettlieffii, S. grandiflora, S. pulvinata, S. scnilis, S. gemmiflora* and *S. glanduliflora.* Of the smaller genera, Caralluma and Huernia furnish the most attractive plants in such species as *C. lutea, C. lateritia, C. mammillaris, H. barbata, H. reticulata* and *H. longituba.* The Hoodias have saucer-shaped salmon-pink flowers, but the plants are delicate when taken to low altitudes. The flowers of Trichocaulon are all small and the plants liable to rot. Piaranthus and Duvalia have small though pretty flowers; their plants are hardy and bear an abundance of blooms. Pectinaria, a genus of five species, with short decumbent stems, has the petals united at their tips. These small flowers are all most beautiful on the inside as seen under a lens. The three remaining genera have one species each in South Africa. *Diplocyatha ciliata* has cream-coloured flowers, about three inches in diameter, with vibratile white hairs on the margins of the petals. This very desirable plant is a native of the Goup Karroo. *Tavaresia Barklyi* is a small prickly Cactus-like species from the Upper Karroo. Its flowers are tubular and prettily marked within. *Huerniopsis decipiens* from Bechuanaland is modest in appearance, yet the flowers are brightly coloured. It is by no means least among the strange plants of this fascinating tribe.

N. S. Pillans.

PROGRESS AT KIRSTENBOSCH.

THE following summary of the principal work done in the Gardens to date is recorded for the information of those members of the Society who are unable to keep themselves acquainted with the progress of the work by frequent visits to Kirstenbosch.

The dripping krantzes and other construction work around the Bath have been completed, and the path cobbled to opposite Pan's Pool. Storm-water drainage and catchpits have been laid from the back of the Bath to connect up with the existing drainage at the Aloe Kopje.

In 1919 the collection of Proteaceae was increased by 360 plants, and during 1920 there have been planted 630 more, this being the maximum yet reached in one season. Many species have flowered this season and have been a source of great attraction and interest to visitors.

This season there have been planted out 480 Heaths on the south-eastern slope of the Kaffir-boom Knoll.

On the southern slope of the Cycad Amphitheatre the ground around Dr. Pearson's grave has been planted with grass, a double row of juniper being planted to form a low broad hedge on each side of the path through the area. Outside the hedge a few species of Northern African Conifers have been regularly disposed. It will be interesting to record that these plants were raised from seed obtained by almost, if not quite, the last requests to various gardens and botanists by the late Director in pursuance of his intention to establish these gymnosperms on this site. The Araucaria was planted by him personally, as well as the Ginkgos further along the slope. The Florida lawn grass within the kerb has been replaced by a promising Kirstenbosch grass, as the former was unsatisfactory during a portion of the year. The path has been kerbed, and set with sandstone blocks.

In the Economic Grounds two lots of *Mentha piperita,* the Peppermint of commerce, have been safely established, and promise a large yield this season. Good stands of *Pelargonium vitifolium* and *P. capitatum* have been planted to supply material for the distillation of their essential oils. Young plants of the much esteemed Pecan Nut and the Queensland Nut have been planted out. A plantation of about an acre in extent has been formed of Cork Oaks on the top of Wynberg Hill, and a line of 22 trees about halfway down the hill. The Hops have increased in number and strength, and will now yield sufficient sets for a fairly large stand. A crop of about 400 lbs. of dried leaves of Buchu was obtained during 1919, and about 150 lbs. from the row of *Barosma crenulata.* During 1920 the yield of *B. betulina* was over 700 lbs.

The roadway around the Aloe Kopje has been excavated for a hundred yards, on half of which the stone foundation has been laid, napped and blinded with gravel. A portion of the excavated soil has been used to raise the levels of the Pelargonium and Daisy Gardens. Other surplus material has also been used to form a road between Nursery and Skeleton streams, a section of the Circular Road past the Ruins.

The workmen's cottages were completed in June, 1919, and are fully occupied, mainly as a temporary Hostel.

J. W. MATHEWS.

NOTES ON THE SUPPLEMENTARY PLATE.

THE Wild Flower Protection Society proposes to issue plates of the flowers protected in the Cape Province in about ten series, a series to contain ten plates. Each plate will have one or more species lithographed in outline on paper suitable for painting. The first series has been recently published, and by arrangement with the Society we are able to include a partly-coloured specimen-plate, coloured by hand, in each copy of the Journal sent to Members and Associates. The following are the subjects of this first series:

Antholyza revoluta Red Africander
Antholyza Merianella Flame
Gladiolus debilis Painted Lady
Gladiolus cuspidatus Wavy-pointed Painted Lady
Gladiolus angustus Long-tubed Painted Lady
Gladiolus blandus Broad-leaved Painted Lady
Gladiolus recurvus Blue Africander
Gladiolus spathaceus Caledon Bluebell
Gladiolus Bolusii, var. Burchellii Riversdale Bluebell
Gladiolus alatus Kalkoentje

All these belong to the Iris Family (Iridaceae) and are characterised by having as a rootstock the "dry bulb" or corm, and in the flower—three sepals and three petals, all coloured and petaloid, joined below into a tube; three stamens which arch under the upper petal and three stigmas. The seeds are dry

and winged and thus suitable for distribution by wind. Except in the case of the Red Africander all the lower petals and sepals have markings or "guides" leading to the honey concealed at the base of the tube. The stigmas are usually in front of the stamens so that the visiting insect on entering the flower would come first into contact with and pollinate them, while in retiring it would brush the anthers and tend to close the stigmas. This arrangement would ensure cross-pollination.

The two genera represented are Antholyza (loose flower). and Gladiolus (little sword), differing only in the shape of the tube, which in the former is more abruptly widened above the base and becomes cylindrical, while in the latter the widening is usually more gradual and the upper portion is more or less funnel-shaped, or at any rate never cylindrical.

The Red Africander well deserves both its scientific as well as its pet name, for there is a particular looseness and grace both in the arrangement of the flowers on the stem and of the richly coloured segments themselves, as they fall outwards, and curve backwards or revolve. On the Peninsula it used to be common enough on the lower slopes of the Devil's Mountain, and no doubt gave "Roodebloem" its name, but now it is found chiefly on the Lion Mountain, being at its best in August. It is also found in the Stellenbosch, Paarl and, above all, in the Darling Districts.

Among our most local and therefore our rarest flowers is the strikingly brilliant-coloured Flame with hairy leaves and much shorter and broader segments than those of the Red Africander. Found only on the Peninsula, and never known to have crossed Constantia Nek, it has been driven ever southward, until now the few short miles between Smitswinkel and Buffel's Bay comprise its native habitat. Here it is fully exposed to the hand of the destroyer, for there are no mountain-fastnesses to serve as a refuge —only the waves that beat round the rocky extremity of this Cape of Storms.

The Blue Africander is also found in the southern portion of the Peninsula, Kalk Bay Mountains, Cape Flats, and above Hout Bay; while outside the Peninsula it has an extremely wide range reaching as far as Port Elizabeth. It is very variable in colour, being sometimes a rather pale blue with a darker band in the middle of the recurving segments, sometimes a mauve blue, and often of a brownish or brownish-yellow tinge. The flower in every case is very sweetly scented, and can be recognised by this and by the long-sheathing basal leaf which is always snake-spotted.

In the Bluebells the segments are very broad and cling together, only recurving gently near the apex to form the flow of the bell. The leaves are very narrow and in the Caledon Bluebell very short, scarcely ever exceeding two or three inches, while those of the Riversdale Bluebell attain a foot in length. The bract of the former is also longer, sharply pointed, and finely nerved.

Among the Painted Ladies the white-flowered one with very narrow leaves and a sharply pointed bract is easy to distinguish. The segments are broad and rounded, and the painting on the lower ones is irregular, and often suggests a fortuitous spattering of colour. It is especially beautiful in its setting of grasses and Restiaceae—often leaning upon their firm support, so that it has earned for itself the name of "debilis" or weak. The other Painted Ladies have the "painting" of the more definite spade-shaped type. The Broad-leaved Painted Lady has a much shorter tube, and the segments have a more graceful flow than those of the Wavy-pointed and Long-tubed Ladies. The two latter have rather narrower segments and are very closely allied, although extreme forms are distinct enough.

The Wavy-pointed has the points of the segments longer (more extended or cuspidate) and more conspicuously waved, and has broader and more strongly ribbed leaves, while the Long-tubed is more easily recognised in the side view where the lower segments appear shorter than the upper.

In the Kalkoentje the segments are broad, the lower ones being green with only the tip red. The stem is flattened and drawn out into narrow wings which accounts for the name "alatus" or winged, while the often turkey-red colour of the flower has no doubt suggested the vernacular name.

L. Bolus.

CULTIVATION.

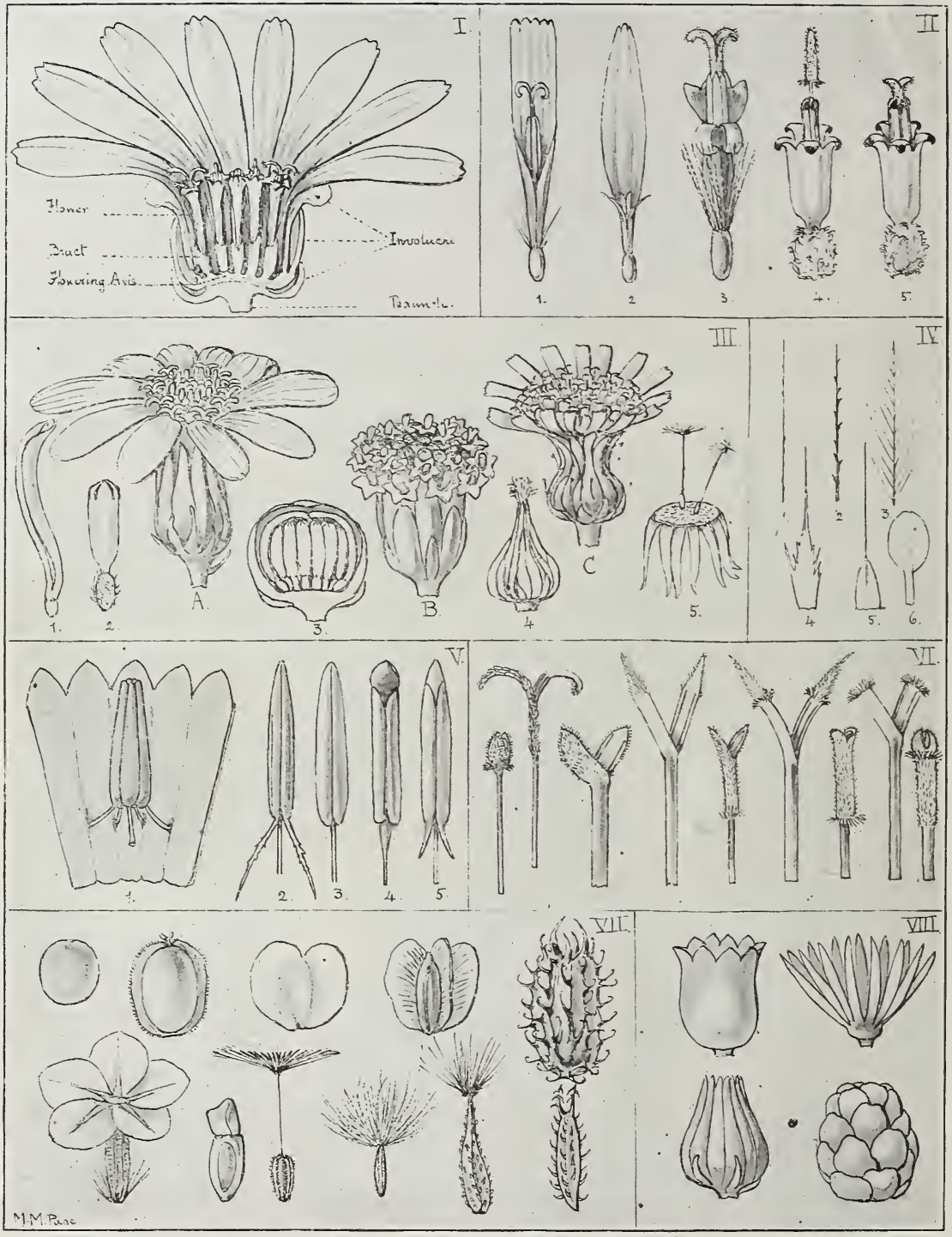
The species of Antholyza and Gladiolus under consideration can be broadly divided into three groups according to their general cultural requirements.

In the first group can be placed *Antholyza Merianella, Gladiolus recurvus, Gladiolus spathaceus,* and *Gladiolus Bolusii, var Burchellii.* These require a compost of sand and leafmould or peat in equal proportions. The last is a streamside bulb and delights in a fair amount of shade. The other Gladioli and Antholyza delight in full sun, but differ as to the amount of moisture, the "Flame" liking or at any rate withstanding occasional floods, while the Gladioli usually obtain only the rainfall moisture.

In a second group may be placed *Gladiolus cuspidatus, G. angustus,* and *G. alatus* which mainly favour a soil almost composed of sand, with the first and last under rainfall moisture, and the other in rather damper situations. Under garden cultivation a porous sandy loam suits them well with full sun.

Antholyza revoluta, Gladiolus blandus, and *G. debilis* thrive in a good loam, well drained, but with abundant rainfall moisture during growth in the case of the two first; *G. debilis,* however, does well in a much warmer and drier situation.

J. W. Mathews.


I.
Flower
Bract
Flowering Axis
Involucre
Peduncle.
II.
1.
2
3.
4.
5.
III.
1.
2.
A
3.
B.
4
C
5.
IV.
2
3
4
5.
6.
V.
1.
2.
3.
4.
5
VI.
VII.
VIII.
M.M. Pace

Compositæ.

NOTES ON COMPOSITAE.

THIS Family includes all the well-known daisies and marguerites, as well as many others whose relationship to the daisy is not recognised at the first glance. It has always held its place in our flower-gardens, where it would be hard indeed to have to do without the sunflowers, chrysanthemums, dahlias, zinnias, cinerarias, gaillardias, asters, and many others to which South Africa has added some valuable allies in the beautiful Barberton daisy (*Gerbera Jamesoni*) and the rich gousbloemen (Gazania, Arctotis, etc.)

Although the Compositae cannot be compared with

whose four or five petals are joined together into a tube (gamopetalous), a form better adapted to the protection of honey than the simpler corolla consisting of separate petals; (2) the four or five anthers, also joined by their edges (syngenesious), which shed their pollen inwards; (3) the mechanism by means of which the elongating style pushes the folded brush-like stigmas through the anther-tube and well above it, so that the pollen is presented in the most accessible manner; (4) the development of the stamens being earlier than the carpels to favour cross-pollination, and at the same time, should this fail, the certainty of

EXPLANATION OF PLATE.

I. HEAD, longitudinal section.

II. FLOWERS.—Fig. 1, ray-flower; 2, do., bilabiate; 3, disk-flower, do.; 4, do., regular, first stage; 5, do., second stage.

III. A. Head composed of ray and disk-flowers. Fig. 1, ray-flower, in bud; 2, disk-flower, do. B. Head composed of disk-flowers. Fig. 3, do., in bud. C. Head composed of ray-flowers. Fig. 4, do., after pollination; 5, do., in fruit.

IV. PAPPUS.—Fig. 1, bristle; 2, barbed bristle; 3, plume; 4, 5, 6, scales.

V. ANDROECIUM.—Fig. 1, showing adnation to corolla; 2, anther, with tails; 3, do., without tails; 4, do., with barren apex; 5, do., with tails.

VI. GYNAECEUM, showing forms of style-branches.

VII. FRUITS, showing wings, sails, plumes and attachment-hooks.

VIII. INVOLUCRE, showing the leaves united or separate, and in one or several series.

animal, and one asks the natural question—to what factors is their success due? To answer this it is necessary to examine the structure of the flowers in some detail.

The most obvious characteristic of the Family is the "composing" or massing of the flowers into heads surrounded by special leaves which form an envelope or involucre to hold them, and serve as one large calyx. This massing tends to a saving of calyx- and corolla-material without a loss of conspicuousness; but probably the greatest gain lies in the fact that one insect-visitor would be able to pollinate a number of flowers in a much shorter time than if it had to travel from flower to flower in a less closely massed inflorescence. Further advantageous characteristics are to be found in:—(1) the corolla

are either composed entirely of the typical tubular flowers with their five corolla-segments valvate in the bud; or of these with the addition of more showy magenta, blue, white or yellow ray-flowers, where two of the segments are usually suppressed, and the remaining three drawn out on one side and united to form a strap which is involute in the bud; or, lastly, composed entirely of flowers whose five petals are united almost to the very tip to form a strap, which also is involute in the bud. The scales of the involucre, arranged in one or more series, may be herbaceous or membranous or coloured and opaque; while the fruits may be furnished with wings or with a pappus of scales, plumes, or bristles to favour dispersal by wind, or with hooks and sometimes a stickiness to ensure transport by animals, or even

having a juiciness, as in the boeta bessie (*Osteospermum moniliferum*) which renders them palatable.

It is during the latter part of spring and all through the summer that our composites at Kirstenbosch are at their best. In the sunniest localities the cheerful Chrysocoma, or golden-hair, beams upon us and the gleaming white rays of Dimorphotheca are spread in all their beauty. Scrambling in the thickest bush the yellow-rayed *Ursinia dentata* and the white-rayed *Felicia reflexa* peep out from the tangle, while in damp places are rambling masses of *Osteospermum ciliatum* and *Helichrysum marifolium*. Later on the yellow heads of *Athanasia parviflora* and *A. crithmifolia* and of the sturdy *Senecio rigidus* are conspicuous in flat-topped clusters, and the graceful *Senecio grandiflorus* with magenta-purple rays flourishes in the more sheltered localities on the mountain-side. What a brave show it is "when the sun rides high, and the dew is gone, and noon lies heavy on flower and tree"; but when "the weary day turns to his rest" the peduncles of Ursinia curve till the nodding heads look earthward, while the rays of Felicia point upward and touch faces, showing their pretty pink back, and those of Dimorphotheca lash themselves tightly over the disk, and wear their purplish brown nightdresses beneath whose cover many a tiny Ariel sleeps secure.

KEY TO THE GENERA NATIVE TO KIRSTENBOSCH.

Heads with tubular flowers:—

Heads with rays.
- Some of the tubular flowers bilabiate ... **Gerbera.**
- None of the tubular flowers bilabiate.
 - Tip of the peduncle inflated **Cotula.**
 - Tip of the peduncle not inflated.
 - Innermost scales of the involucre membranous at the apex.
 - Outer scales of the involucre with foliaceous tips.
 - Rays fertile **Arctotis.**
 - Rays barren **Cryptostemma.**
 - Outer scales of the involucre without foliaceous tips ... **Ursinia.**
 - Innermost scales of the involucre not membranous at the apex.
 - Pappus well developed.
 - Rays yellow, pink, or magenta.
 - Plant prickly **Berkheya.**
 - Plant not prickly.
 - Rays slightly longer than the involucre **Pulicaria.**
 - Rays much longer than the involucre.
 - Leaves broad, usually entire, thickly felted beneath ... **Alciope.**
 - Leaves not as above.
 - Pappus with attachment-hooks ... **Bidens.**
 - Pappus adapted for wind-dispersal.
 - Nut compressed, narrowly winged on the margin ... **Cineraria.**
 - Nut not as above.
 - Involucral scales in one series, not awned ... **Senecio.**
 - Involucral scales in many series, awned ... **Athrixia.**
 - Pappus none or very minute.
 - Rays white or blue.
 - Rays minute **Erigeron.**
 - Rays conspicuous **Felicia.**
 - Pappus none or very minute.
 - Rays white.
 - Disk-fls. purplish .. **Dimorphotheca.**
 - Disk-fls. yellow **Osmitopsis.**
 - Rays yellow.
 - Nut densely woolly ... **Cryptostemma.**
 - Nut not densely woolly.
 - Nut distinctly three-winged **Tripteris.**
 - Nut not, or scarcely, winged.
 - Scales of the involucre spinously ciliate **Cullumia.**
 - Scales of the involucre not spinously ciliate ... **Osteospermum.**

Heads without rays.
- Involucre herbaceous, usually green.
 - Leaves entire. ...
 - Leaves less than 1/6 in. broad, **Chrysocoma.**
 - Leaves more than 1/3 in. broad, **Tarchonanthus.**
 - Leaves not entire.
 - Annuals.
 - Pappus of 2-5 bristles **Bidens.**
 - Pappus copious, of hairs **Conyza.**
 - Perennials.
 - Pappus of many white hairs ... **Senecio.**
 - Pappus none or not of white hairs.
 - Decumbent or scrambling, in damp places **Hippia.**
 - Not as above **Athanasia.**
- Involucre membranous or petaloid.
 - Heads 1-fld., closely massed **Stoebe.**
 - Heads more than 1-fld.
 - Leaves entire or very nearly so.
 - Leaves tomentose on the upper surface, spirally twisted. **Metalasia.**
 - Leaves not as above.
 - Flowering-axis woolly **Anaxeton.**

Flowering-axis not woolly.
Pappus of plumes.
Heads many-fld. ... **Helipterum.**
Heads few-fld. (up to 8) **Elytropappus.**
Pappus not of plumes.
Pappus copious, of hairs or bristles.
All the flowers similar or only a few outer ones differing in form.
Scales of the involucre acuminate ... **Leontonyx.**
Scales of the involucre not acuminate, **Helichrysum.**
Many of the outer flowers differing in form **Gnaphalium.**
Leaves deeply cut **Athanasia.**
Heads without tubular flowers:—
Flowers white or pale blue **Lactuca.**
Flowers yellow.
Pappus plumose.
Involucre of 1 series **Urospermum.**
Involucre of more than 1 series, **Hypochaeris.**
Pappus of silky hairs **Sonchus.**

L. Bolus.

THE MONT-AUX-SOURCES NATIONAL PARK.

NOTES ON ITS VEGETATION.

By J. W. Bews, D.Sc.
(Professor of Botany, Natal University College, Member of the National Park Committee.)

THERE are few, if any, localities in South Africa more interesting to the botanist than the National Park in the Mont-aux-Sources region of the Drakensberg. From the valley of the Tugela, at the south entrance to the park, up to the summit of the Mont-aux-Sources, one ascends more than 6,000 feet, first over the comparatively even slopes of the horizontal shales and sandstones (Red Beds of the Stormberg series), then through narrow gorges over the Cave Sandstones which nearly everywhere form cliffs that are covered in great vertical strips by an interesting assemblage of Blue-Green Algae—primitive colonisers—and finally over three or four thousand feet of amygdaloidal basaltic lavas everywhere steeply cut by the Tugela and its tributary streams. The grandeur of the scenery is hardly surpassed in any region of the world.

A detailed but by no means exhaustive account of the Drakensberg vegetation has been given by the writer elsewhere.* In the present article only such points will be touched upon as appear of outstanding importance or likely to be of interest to the general reader.

The first point to notice is the extraordinary number of separate types of plant community. Below the Cave Sandstones there are areas of forest, a climax type rendered possible by the comparative stability of the environmental conditions. It is of the usual somewhat mixed type with the Yellowwood (*Podocarpus latifolia* and *P. elongata*) fairly abundant. It is interesting to note that the species *Podocarpus falcata,* which is completely dominant a little further south along the range, does not occur at the Mont-aux-Sources, or at least it has not so far been discovered there. There is every reason to believe that in the case of this falcate Yellowwood we have a recent mutation of sufficient importance to be able to assume almost complete dominance. Being a young species it has not had time to spread very far as yet.

The margin of the forest and all the smaller valleys and ravines are filled with scrub, made up of very numerous species but with the Oudehout (*Leucosidea sericea*), an interesting Rosaceous species, usually dominant. *Buddleia salviaefolia,* (Sagewood), *Heteromorpha arborescens,* (a tree Umbellifer), *Cussonia spicata,* (Cabbage tree), *Royena lucida, Rhus dentata,* are the most important of its associates. Just as the scrub is marginal to the forest and represents an earlier stage of succession, so around the scrub itself is a still earlier stage of low sclerophyllous shrubs such as *Cliffortia linearifolia, Passerina filiformis, Myrsine africana,* and occasionally one or two of the Ericas which are more abundant at the higher altitudes. The conditions on the Drakensberg, however, are of so unstable a nature owing to the rapid rate of denudation and the cutting away of the cliffs and steep rocky slopes, that the full succession to forest is rarely seen. Hence the extraordinary abundance of scrub.

The species *Greyia Sutherlandi* (Bottle-brush) is confined for the most part to rocky patches on the slopes below the Cave Sandstones and forms a kind of "Rocky Scrub" of its own that is worth distinguishing from the more common Leucosidea Scrub.

Mountain Grassveld occupies the even slopes, where the rock has been covered by soil. On some of the buttresses grassveld goes nearly to the summit. The

*Bews, J. W. The Plant Ecology of the Drakensberg Range. Annals of the Natal Museum. 1917.

grasses grow in hard compact tussocks, the soil being caught and held between the bases of the culms. The dominant species belong mostly to temperate tribes, being included in the genera Microchloa, Harpechloa, Poa, Festuca, Koeleria, etc., but there is always an admixture of more tropical kinds, species of Andropogon, Anthistiria, Eragrostis, Aristida, etc. The grassveld of the lower portions of the park is essentially the same as that of the midlands of Natal and most of the whole eastern grassveld region.

Protea Veld is formed over wide areas by the invasion of the grassveld by various species of Protea (*P. Roupelliae* and others). The trees grow isolated, forming a park-like type of plant community, and this type of plant succession, which is similar to that in the Thorn Veld at lower altitudes and Tree Veld generally over about a third at least of the whole continent of Africa, has many points of peculiar interest. The trees in this case are the pioneers and they are followed, not preceded, by shrubs as in true forest successions.

Above the Cave Sandstones there is a considerable development of Macchia which is essentially identical in its main features with that of the Cape, a fact on which considerable emphasis should be laid. The genera and in many cases even the species are the same as those found at the Cape. *Metalasia muricata, Phylica paniculata, Passerina ericoides, Myrsine africana, Cliffortia linearifolia,* are prominent examples. There are nine or ten species of Erica but the Compositae are of most importance, being represented by a great many shrubby forms. There are also many bulbous Monocotyledons. Mixed with the shrubs are grasses of a distinctly south-western type.

A very brief reference to the numerous minor types of plant community must suffice. The vleis and marshy spots generally along the stream banks at lower altitudes support an unstable type of vegetation representing an early stage of succession. Grasses and sedges are dominant but the numerous associated plants are on the whole more interesting. There are a great many showy ground orchids belonging to the genera Satyrium, Disa, Brachycorythis, Habenaria, Corycium, Brownleea, Disperis, Pterygodium, as well as many beautiful bulbous Monocotyledons. Some of these vlei plants are apparently very rare and their protection in the National Park must be rigidly enforced.

Throughout the grassveld and around the margins of the Scrub there are found scattered a great many interesting species. *Encephalartos Ghellinckii* is common in places. *Sutherlandia frutescens* is abundant especially near rocky stream channels. *Anemone fanniniae* grows in moist depressions. Numerous Pelargoniums are found scattered through the grassveld together with hundreds of other species. The genus Helichrysum is much in evidence. Orchids and various lilies, etc., however characteristic they may be of the vleis, are by no means absent from the grassveld.

The second point on which emphasis may be laid is that not only is there a great variety of plant community present, but all such communities are existing under very unstable conditions, a fact already mentioned. Everywhere there is constant change. Full successions are rare. Further, not only are conditions unstable but they are also very varied. A suitable environment can be found for almost any species no matter what its requirements. There are cold areas, and again owing to rapid cold air drainage there are frost-free localities. There are many densely shady spots never reached by the direct sunlight, while exposed situations have the brilliant sunshine of high altitudes. There are many moist spots near the numerous dripping waterfalls, and many very dry situations.

Under such conditions probably new species are produced more frequently than elsewhere, a theory supported by the fact that there are a great many rare endemics to be found here. A new mutation can be easily destroyed if man's interference is allowed, another reason for the necessity for flower protection in this area. The variety and instability of the environmental conditions also probably afford an explanation of the fact that in this as in other countries species tend to spread most rapidly along the mountain ranges.

This leads us on to a third point, namely, that the flora of this region helps us to understand or at any-rate throws light on the question of the geographical distribution of plants in general and the origin and distribution of South African plants in particular. It is unfortunate that the earlier writers on the plant geography of South Africa had not become more familiar with the Drakensberg flora. Over 6,000 feet it is to a large extent a Cape flora. Below the Cave Sandstones even, there is the extensively developed Protea Veld. No mere lists of species can give any idea of the richness of this south-western flora in the Drakensberg. The question then arises as to whether this Drakensberg flora represents a Cape flora which has extended eastward and northward, or whether the Cape flora represents a recent differentiation of more ancient invaders from the north which have travelled southwards towards the Cape along the mountain ranges, leaving descendants along their path, *e.g.,* in the Drakensberg. We need not attempt to answer this question at present, but enough has been said to illustrate once more the importance of this flora and the necessity for its preservation.

There are many other points that might have been noticed did space permit. The ecologist or plant physiologist visiting the National Park finds himself faced on every hand by interesting problems. It is a meeting ground of types, tropical species and temperate species, eastern species and south-western species, and every conceivable growth form is represented. There is room for endless comparisons and the comparative method so fruitful in results as applied to plant morphology in the laboratory has not

been applied half enough to physiology and in the field.

Plant ecology has now reached a stage when important generalisations are possible. The study of the vegetation of the National Park in itself enables us to reach several, in directions which have been little more than hinted at in this brief account.

The points which have been touched upon are it is hoped sufficient to show that we have reason for satisfaction in the fact that this very wonderful botanical area has become the property of the Union; that not only will the rarer plants be protected, but that Nature's processes in connection with the growth, change, and development of the many varied types of plant community will be allowed to go on under the influence of natural environmental conditions without human interference. Future generations of botanists will be grateful to us for the steps that have been taken to bring this about.

SOME RECENT PUBLICATIONS.

Mr. N. E. Brown of Kew has published (Journal of the Linnean Society, Vol. XLV., July, 1920) an account of some "New and Old Species of Mesembryanthemum, with critical notes." Mr. Brown has specialised for many years in the study of this vast and important genus, the largest single genus in the South African flora, and including an amazing range of vegetative types combined with a singular uniformity in flower-structure. The National Botanic Gardens have been able to assist Mr. Brown in monographing this genus, and have received from him generous contributions of living specimens authentically named. A wonderfully complete evolutionary series can be traced in the genus, and Mr. Brown regards the simple "Sphaeroid" type as having given rise to the bushy and trailing forms—a view which will certainly arouse criticism. Mr. Brown writes: "It is a matter of great regret to learn from various South African botanists that many species [of succulents] are in danger of complete extermination by ostriches. In a few years time, unless care is taken to preserve them, some of these remarkable plants may have disappeared for ever." The moral is obvious —nature reserves are urgently needed: and as Dr. Pole-Evans writes in a letter to Mr. Brown, "we should make an endeavour to place many of our interesting South African plants in a spot or collection where they will be safe from the depredations of the Ostrich and Man."

* * *

The first Memoir published under the auspices of the Botanical Survey of South Africa is from the pen of Dr. S. Schonland of the Albany Museum, Grahamstown. It is entitled "The Phanerogamic Flora of the Divisions of Uitenhage and Port Elizabeth," (Price 2/6, from Librarian, Agricultural Department, Union Buildings, Pretoria), and is in the main floristic and geographical. From this point of view the district studied is of great interest as the meeting place of the Eastern and Western coastal-belt floras, lying as it does at the junction of the summer-rain and winter-rain districts. Though rain falls fairly uniformly throughout the year, severe droughts are sometimes experienced and this is reflected in the succulent and xerophilous vegetation of much of the area. Rainfall records are given and there are notes on the different types of vegetation, but no ecological attempt is made to relate these types to the varying factors of soil, climate, exposure, insolation, etc.

* * *

Dr. Harry Bolus' "Orchids of the Cape Peninsula" was published first in 1888, and has been long out of print.

Mrs. Bolus and the late Miss Greene have now prepared a second edition (dated 1918, but only received in Cape Town in September, 1920, owing to war difficulties), published by Messrs. Darter Brothers & Co. This is a fine volume of xxxiv + 142 pp. and 119 coloured plates, embodying the material prepared by Dr. Bolus for a second edition. All the Peninsular Orchids are described and figured (except two which have not been found by any living collector) and most valuable notes are given of localities, time of flowering, variations, etc.

The orchids are the third family in order of number of species in the Cape Peninsula, only surpassed by the Composites and Leguminosae and equalled by the Iridaceae. According to our authors, there is little doubt that they here reach their maximum in South Africa, and are probably even more numerous than in any area of equal extent on the whole continent. All of the Cape Peninsular species are terrestial, the epiphytes of the summer-rainfall districts being absent: though several species inhabit moist rock-ledges from which it is only a step to epiphytism. (cf. our common fern *Polypodium lanceolatum*).

The orchids have a fascination and interest all their own on account of the unique forms and colours of their flowers, the amazing mechanisms connected with their pollination, and the delicacy of their adaptation to their environment—which makes them difficult garden subjects, sensitive to disturbance and cultivation. The present volume should be in the hands of all South African botanists. It is an admirable example of a local sectional flora, full of acute field observations as well as careful herbarium study. Would that we had similar monographs of other groups!

THE PROTECTION OF WILD FLOWERS.

THIS article is primarily to give briefly the Law as it exists to-day regarding the protection of Wild Flowers of the Cape.

Complete ignorance is sometimes pleaded as to the existence of any prohibition whatever but the public generally is found to be vaguely aware that the gathering of certain wild flowers (and when this term is used ferns, shrubs and the bulbs and roots thereof shall be understood to be included) is prohibited.

The Ordinance at present in force (No. 14 of 1916) and the Proclamations thereunder (145 of 1916 and 173 of 1919) forbid (*a*) the gathering, (*b*) uprooting, (*c*) sale and (*d*) export of certain flowers.

The most frequent question asked is: What flowers are protected? The following is the list of the protected flowers for the Cape Division which shall not be "plucked, gathered, uprooted, broken or damaged":—

Botanical Name:	*Common Name:*
Anemone capensis, Linn. ...	Anemone
Liparia sphaerica, Linn. ...	Orange Nodding-Head
Rochea coccinea, D.C.	Red Crassula
Staavia Dodii, Bolus	Large Cream and Black Staavia
Audouinia capitata, Brongn.	Crimson False Heath
Erica halicacaba, Linn.	Green Heath
Harveya capensis, Hook. ...	White Harveya
Protea cynaroides, Linn. ...	Stalk-leaved Giant Protea
Gnidia pinifolia, Linn.	Sweet-scented Cream Gnidia
Brachysiphon imbricatus, A. Juss	Imbricated Penaea
Disa longicornu, Linn.	Drip Disa
D. uniflora, Berg.	Red Disa
D. harveiana, Lindl.	Mauve or Lilac Disa
D. graminifolia, Ker.	Blue Disa
D. ferruginea, Swtz.	Cluster Disa
Witsenia maura, Thunb. ...	Witsenia
Antholyza revoluta, Burm.	Red Afrikander
Antholyza Merianella, Linn	Flames
Gladiolus grandis, Thunb. ...	Large Brown Afrikander
G. maculatus, Sweet	Brown Afrikander
G. tenellus, Jacq.	Small Brown Afrikander
G. recurvus, Linn.	Mauve or Blue Afrikander
G. debilis, Ker.	Painted Lady
G. blandus, Ker.	Broad-leaved Painted Lady
G. angustus, Linn.	Long-tubed Painted Lady
G. hastatus, Linn.	Short-tubed Painted Lady
G. cuspidatus, Jacq.	Wavy-pointed Painted Lady
G. tabularis, Eckl.	Christmas Painted-Lady
G. alatus, Linn.	Red and Green Kalkoentjes
Amaryllis Belladonna, Linn.	Belladonna or March Lily
Nerine (all species)	Nerine
Brunsvigia gigantea, Heist.	Candelabra Lily
Buphane ciliaris, Herb. ...	Ciliated-leaved Brunsvigia
Kniphofia alooides, Moench.	Red-hot Poker
Hemitelia capensis, Br. ...	Tree Fern

This list includes a number of the better known varieties, and if the flowers are not sufficiently well known to discriminate between the protected and unprotected varieties, then, in order to avoid all danger of infringing the Law, obviously the safe course is to refrain from gathering any wild flowers whatever in the Division named.

Beyond the Cape Division similar protection exists in the Bredasdorp, Caledon, Clanwilliam, Ceres, Mossel Bay, Paarl, Stellenbosch, Swellendam, Tulbagh and Worcester Districts, except that the lists for these districts are restricted.

The next question for consideration is: What wild flowers may not be sold? The following is the list of flowers which it is unlawful to "sell within or export from" the whole of the Cape Province:—the whole of the list already given together with

Botanical Name:	*Common Name:*
Rochea (all species)	Crassulas
Erica cyrillaeflora, Salisb. ...	Simon's Bay Mountain Heath
E. tegulaefolia, Salisb.	Overlapping-leaved Heath
E. corydalis, Salisb.	White Petticoat Heath
E. lowryensis, Bolus.	Sir Lowry's Pass Heath
E. glauca, Thunb.	Glauca
E. regia, Bartl.	Elim Heath
E. blenna, Salisb.	Riversdale Orange and Green Heath
E. monsoniana Linn. Fil. ...	Long white papery Heath
E. papyracea, Gath. and Bol. ...	White papery Heath
E. sitiens, Kl.	Thirsty Heath

Botanical Name:	*Common Name:*
E. propendens, Andr.	Pink drooping-bell Heath
E. vestita, Thunb.	Wide-mouthed Heath
E. sacciflora, Salisb.	Dark-mouthed Heath
E. fastigiata, Linn.	White and Red Four-flowered Heath
E. campanulata, Andr.	Yellow Heath
E. abietina, Linn.	Large Yellow Simon's Town Heath
E. viscaria, Linn.	Sticky Rose-pink Heath
E. viscaria, Linn. var. decora, Bolus ...	—
E. ventricosa, Andr.	Ventricosa
Harveya (all species)	Harveya
Protea rosacea, L....	Mountain Rose
P. Dykei, Phillips	—
Serruria florida, Kn.	Small White Protea
Orchids (all species)	Orchids
Ixia viridiflora, Lam.	Green Ixia
Freesia refracta, Klatt.	Freesia
Tritonia crocata, Ker.	Mossel Bay Kalkoentjes
T. hyalina, Bkr.	Mossel Bay Kalkoentjes
Gladiolus spathaceus, Pappe	Bluebells
G. involutus, Delar.	Bluebells
G. inflatus, Thunb.	Bluebells
Adiantum Capillus Veneris, Linn. major	Large Maidenhair Fern
A. Capillus Veneris, Linn. minor	Hardy Maidenhair Fern
A. aethiopicum, Linn.	Eastern Maidenhair Fern
A. thalictroides, Wild	Western Maidenhair Fern
Cyathea Dregei, Kunze ...	Eastern Tree Fern

Unfortunately there is no penalty in the existing Law attaching to the actual *purchasing* of wild flowers. This is a provision still to be striven for. But here again it is the plain duty of every individual not familiar with the protected varieties, not only to refrain from selling any wild flowers but also to refrain from purchasing. Our coloured fellow-citizens would have little incentive to break the Law with regard to gathering and selling protected flowers, if greater care were exercised in refraining from purchasing such, whether by those who know that the flowers offered are protected or by those who were not sure on the point.

The next question for consideration is as to the position of protected flowers which are grown or gathered upon private land by the owner himself or with his consent. An owner of private land may pluck and gather all wild flowers growing on his land and any person may do likewise provided he obtains written permission from such owner. Such owner may not however sell or export protected flowers even though they are grown on his own land nor can he grant permission to any one whatever to do so.

The Ordinance also provides that no wild flowers whatever, including the unprotected varieties, shall be sold by any person without a licence for this purpose. Provision is further made for the granting of special permits by the Administrator under which the grantees may be permitted to pluck and gather protected flowers "for the purpose of exhibition at Agricultural, Horticultural or other Shows or Exhibitions, for scientific (botanical) purposes, ..." It is gratifying to note that the Administrator is exercising the greatest care in granting permits under this section and a strict investigation is made into each application and unless the terms of the section are fully complied with, the permit is withheld.

It remains to mention the two most important sections of the Ordinance which contain unusually helpful provisions for the enforcement of protection. It is an elementary principle of Criminal Law that the onus or burden of proving the crime or offence rests upon the prosecution. It may be realised, however, that in the vast majority of cases it would have been impossible for the Police to have proven that a person found with protected wild flowers was in illegal possession thereof: in other words, the impossibility of catching the offender actually plucking the flowers was realised in almost every case. The Provincial Council therefore, recognising this fact, permitted the inclusion of a very helpful, though unusual, provision in the Ordinance which is as follows: "any person found in possession of any flowers, etc., the plucking, gathering, uprooting, breaking or damaging whereof has been prohibited, *the burden of proving* that he is not liable to a penalty shall lie upon such person." In brief, the effect is that the Police may prosecute any person in possession of a protected flower and the accused is liable to a penalty unless he can show that he is in lawful possession.

The other provision referred to is deemed of sufficient importance to warrant its full quotation, which is as follows: "Upon reasonable grounds of suspicion that any person has offended against the provisions of this Ordinance, so far as it relates to wild flowers, ferns, and shrubs, or any regulation framed thereunder, it shall be lawful for any police constable or for any person who shall produce written authority from the Commissioner of Police to require the person suspected of such offence to give his name and place of abode, and in case such person shall, after being so required, refuse to give his name and place of abode, or give an untrue name or place of

abode, he shall be liable, on being convicted of any such offence, to a penalty not exceeding twenty shillings in addition to any penalty which may otherwise be imposed, or in default of payment thereof to imprisonment with or without hard labour for a period not exceeding seven days."

Two points are to be noted. First the Police are empowered to require the name and address of any person merely in possession of a protected flower or who is suspected of an offence under the Proclamation and Regulations. Second, the Section virtually provides for the appointment of private individuals with power to exercise the functions of a Police Officer in enforcing the law. As a matter of fact some 22 individuals have actually obtained the necessary "written authority" or warrant from the Commissioner of Police and they have rendered invaluable service in aiding in the enforcement of the Ordinance. It is not perhaps generally known by members of the public that if they carry or wear a protected flower they may be accosted by a private individual to whom they are legally bound to furnish their name and address, upon his producing his necessary warrant.

From the foregoing brief account it will be seen that the provisions of the existing law are strong and helpful and the question which naturally follows is as to the effect of such upon the preservation of our Flora. Has it been wholly beneficial? Unfortunately the reply is that the Law has had a beneficial effect only up to a certain point. The Police authorities were interviewed expressly for the purpose of this Article, and while they considered that the existing Law was amply sufficient the great difficulties of enforcement were pointed out and these must undoubtedly be generally recognised. Briefly the chief points of difficulty are: (*a*) The fact that it is impossible for the average Police Officer to know and recognise the protected varieties. (*b*) The fact that there are scores of householders (and this applies particularly to the Southern Suburbs of Cape Town and the False Bay Coast) who still illegally purchase the protected flowers which are mostly hidden in the baskets of the coloured vendors under the unprotected and cultivated flowers. It is stated that were it not for the number and extent of this class of clientèle who are willing to pay high prices, there would be little incentive to the coloured folk to break the Law. (*c*) The insufficiency of the penalty imposed under the Ordinance when a conviction is obtained. It has been proved over and over again that owing to the smallness of the fine, a conviction has not proved a deterrent to a repetition of the offence. A stiff and salutary fine is desired.

Despite these and other difficulties it is gratifying to note that within the past few months some fifty convictions have been obtained. Further, the Police authorities desire and welcome the aid of qualified laymen. Fifty convictions in a few months sounds well, but the evidence of our Botanical Experts, our Mountaineers and of the ever-growing number of other individuals who have the preservation of the Cape Flora at heart, all goes to show conclusively that *unless the Law is itself made stricter and the existing Law in the meantime more successfully enforced, many, if not all, of the present protected flowers and many of the unprotected are in danger of extermination.* No authority of any weight has been found who is able to dispute this fact—a terrible fact indeed when we consider the possibility of the loss even to this generation but particularly to future generations. The matter is urgent and should engage the immediate and active attention of every citizen who is capable of recognising the value of our "great heritage of flowers"; and although at the risk of travelling outside the scope of this Article, the following suggestions are offered for consideration with the object of (*a*) better enforcement and (*b*) future improvement, of the Law:—

1. The Cape Peninsula, that is all Crown Lands therein and especially Mountain areas, to be created prohibited areas for all wild flowers for a term of years or in perpetuity: all other Crown Lands to be created prohibited areas for a term of years.

2. Provision to be made (if possible) authorising the Police authorities to search boxes and packages on South African Railways suspected of containing protected flowers.

3. To augment still further the protected lists to be published under the new Ordinance No. 16 of 1920 which comes into force in January, 1921, by the addition of such flowers as chinkerichee, sugar bush, watsonias, and the remaining heaths and gladioli.

4. To make it unlawful in the New Regulations to "offer or expose for sale" as well as to "sell" as hitherto.

5. To obtain the appointment of more qualified and efficient warrant holders under Section 7 of the Ordinance.

6. To impose a penalty for purchasing prohibited flowers, and to increase all the penalties for offences under the Ordinance.

7. To seek to strengthen the law prohibiting (*a*) veld burning, and (*b*) the planting of exotic trees on Crown lands which are known to be rich in flora.

8. To obtain the appointment of (*a*) a Government Commissioner to have charge of the protection of the Flora of the Union; (*b*) a greater number of Rangers in the richer floral regions.

9. Education of the Public in an appreciation and knowledge of the Wild Flowers of the Cape with a view to their protection—specific suggestions under this head are deemed unnecessary.

D. Gordon Mills.

THE BOTANICAL SOCIETY OF SOUTH AFRICA.

ANNUAL REPORT, 1919.

IN submitting the Eighth Annual Report of the Society, the Council has pleasure in intimating that the membership shows a substantial increase and now amounts to 50 Life Members, 320 Ordinary Members, 84 Associate Members and 38 Family Members.

From current revenue for the year the sum of £290 19s. 3d. has been available for the purpose of augmenting the funds of the Trustees of the National Botanic Gardens, as compared with £299 12s. 6d. in 1918.

At the Annual General Meeting held on April 15th, 1919, the following were elected as Members of the Council for the year:—

Lady Rose-Innes, O.B.E.
Mrs. Carter.
Miss W. M. Garlick.
Mrs. F. Bolus.
Miss Fairbridge.
Miss M. White.
Mrs. B. Lawrence.
Mrs. Pearson.
Mr. W. Duncan Baxter.
Mr. W. A. Eaton.
Mr. A. H. Reid.
Mr. J. Storr Lister, I.S.O.
Hon. Mr. Justice Searle.
Mr. A. Walsh.
Professor D. Thoday.
Professor R. H. Compton.
Mr. G. B. van Zijl, M.L.A.
Mr. G. M. Findlay.

The Right Hon. Sir James Rose-Innes, K.C.M.G., was re-elected President, and Sir Lionel Phillips, Bart., Sir Lewis Michell, K.C.V.O. and the Hon. W. P. Schreiner, K.C., Vice-Presidents. The Council appointed Mr. W. Duncan Baxter, M.L.A., as Chairman, Mr. H. T. Twentyman Jones, Hon. Treasurer, and Mr. F. E. Cartwright, Hon. Secretary.

The Society has to deplore the death of the Hon. W. P. Schreiner, K.C., one of its Vice-Presidents, who took an active part in founding the Society.

Four meetings of the Council were held during the year. The Annual Gathering of Members of the Society took place at Kirstenbosch on Saturday, December 16th, and was well attended by members and their friends. Professor Compton, the Hon. Director, delivered an address in the course of which he explained the various improvements effected during the year and in contemplation.

JOURNAL.—The publication of the Society's Journal for 1919 resulted in an interesting number which attracted considerable attention, and thanks are due to the Editor (Professor Compton), and those who contributed articles to it. The demand for copies of the Journal continues to grow and it has been found necessary to increase the number of copies printed. From all parts of the world, enquiries for copies and letters of appreciation have been received. The cost has increased owing to the high price of printing and paper, but the Council feels that the expenditure is justified in maintaining a Journal of high standing.

During the past year a Catalogue, arranged in botanical sequence, of the native plants in the Gardens was begun under the auspices of the Society, and notes relating to the flowering-period, colour of flowers, etc., were added. Seventeen of the largest Orders have already been catalogued, making a total of 1086 species, and it is estimated that there are still some 300 species to be added. These figures show that a very good beginning has been made in the establishment at the Gardens of the native flora from all parts of the Union.

Early in the present year the Society arranged for conducted rambles over Kirstenbosch. By these arrangements all students of botany in the Peninsula, who are writing the Matriculation Examination this year, are enabled to spend four days (one at each season of the year), intelligently at Kirstenbosch. The rambles were adapted more particularly to the requirements of students of Botany and Nature-study, and have been thoroughly appreciated. It is satisfactory to be able to report that all the High Schools in the Peninsula, as well as the Training College, have responded.

It is hoped that these rambles may be developed further in the future, and that they may prove to be among the Society's most useful activities.

The progress of the National Botanic Gardens has again been handicapped by lack of funds and it has been found necessary to make a special appeal to the public for funds to assist in carrying on the work at Kirstenbosch during 1920. This has resulted, so far, in the gratifying amount of £491 0s. 6d. being contributed and promised, which will be of great assistance to the Trustees in their difficult task of keeping things going. The repeated appeals of the Trustees to Government for an increased grant have only resulted in a promise to restore the grant to the original amount of £1,000 per annum, from which it was reduced to £750 in 1915, as a war measure. It becomes increasingly manifest that the upkeep and development of the Gardens will depend more and more upon the measure of support forthcoming from the Society and public-spirited citizens who recognise the importance of the work. It is therefore important that every effort be made to increase the membership of the Society.

The Council has to thank the City Council and the South African Association for the use of rooms for meetings, and the Press for giving publicity to its reports, etc.

W. DUNCAN BAXTER,
Chairman of Council.
FRANK CARTWRIGHT,
Hon. Secretary.

CAPE TOWN, *March 18th, 1920.*

List of Members of the Botanical Society.

(**LIFE MEMBERS:** FAMILY MEMBERS: Ordinary Members: *Associates.*)

A

ABBOT, C. W.
Ainslie, Miss I.
AKERMAN, CONRAD
Albrecht, C. W.
ALBU, SIR GEORGE
Alexander, Miss E. J.
Anderson, Mrs. T.
Arbuthnot, Miss I.

B

Babbs, A. J.
Babbs, Mrs.
Baker, Lionel
Ball, W. R.
Barclay, H. J.
Barnard, Keppel H.
Battenhausen, C.
Battenhausen, J. W.
Battenhausen, Mrs. J. W.
Basson, W.
BAXTER, W. DUNCAN
BAXTER, MRS. W. DUNCAN
Bean, David
Beard, Miss
Beard, H.
Beard, H. R.
Beattie, Sir J. C.
Beattie, Lady
Beck, Lady
Beck, Lt.-Col. A. A.
Beck, Mrs. A.
BECKER, CARL
Becker, Mrs. D.
BEIT, SIR OTTO
Bell, W. Westray
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SPIDERS AT KIRSTENBOSCH.

THE acquaintance of most people with spiders is both limited and unfortunate. In open-air rambles it is often limited to the annoyance of having to brush a film of web from one's face and the resultant creepy feeling of wondering where the spider is; and in the house it is unfortunate in that the spiders seen there are unprepossessing in appearance, while their webs, being collectors of dust, are regarded as nuisances. Hence the usual feeling towards spiders is one of distaste and disapproval—to say the least. Yet if one looks for them, and observes them in their natural haunts, amidst trees and flowers, bush, fern, and grass, it will be seen that they have beauty of form and colour, ingenuity and art in their tunnelling, building, and weaving, and, moreover, a usefulness in their pursuits. For do they not destroy flies and many other insects which are among mankind's greatest economic enemies? And in addition to their usefulness must be taken into consideration the fact that they are for the most part quite incapable of harm. All spiders of course have fangs and small poison glands, but in 90 per cent. of them the fangs are too weak and circumscribed in action to pierce the human skin. Moreover the poison which a spider keeps in readiness to slay a fly has no particularly harmful effect upon a human being; and a spider when touched almost invariably "feigns death," or else will even sacrifice half its legs in its panic-stricken haste to get away. So that, whilst treating them with care, there is no need to be afraid to look for them and at them, and then friendship improves with acquaintance.

It is with a view to making spider-life a little more intelligible and attractive to those who love to take their rambles and daily walks with a seeing eye that the following notes are being written. Brief as they are it is hoped they may stimulate interest in creatures which are surely undeservedly regarded with apprehension and dislike, creatures not only harmless to man but doing no damage to his crops, stock, or other property; cleanly and often supremely artistic in their work, self-reliant and possessing a patience and industry which are proverbial.

To begin with comes the question—what is a spider? So many things are called spiders which zoologically are not such that one feels tempted to enumerate some of the pitfalls, but it will have to suffice to say that a spider, to be such, must possess only two distinct sections to its body, separated by a constriction: the anterior portion or cephalothorax, bearing eight eyes —sometimes fewer, never more,—and furnished with eight legs and two feeling-organs in the shape of leg-like pedipalps; and the unsegmented hinder portion or abdomen, bearing the spinnerets only on the undersurface.

They belong to the Phylum *Arthropoda* (which includes insects, crustaceans, etc.), to the Class *Arachnida* (which includes the scorpions, mites, ticks, etc., and of which the spiders must be regarded as the most highly organised and the most successful members) and to the Order *Araneida*, which contains some forty Families of spiders. Of those found at the Cape, however, not more than a dozen would come under general notice; but of those dozen or so Families many genera have to be considered.

All spiders are oviparous and the young are hatched in the perfect form, not undergoing stages of

metamorphosis as is frequent in the Class *Insecta*. Growth is marked by a series of moults, and at the final moult the sexes are distinct—the fierce voracious female being usually much larger than the male in the adult state. The eggs are enclosed in an egg-case or cocoon of silk, and, because all spiders employ silk for making this structure, scientists have been led to conclude that the primary use of the silk secreted by the female was for this purpose, the next step being the weaving of a chamber to contain the cocoon, and sometimes to protect the mother while guarding it and her young. From such a structure may have been developed the simple "tubular" web, and from this latter the tunnel and the elaborately finished "trap-door" nests and burrows in the earth seem to have been evolved—all designed to serve as a protection. In a divergent line of development the tubular nest is found in combination with the snare-web in the air, or, finally, the snare only is spun—designed entirely for a means of getting food. But there are other uses to which the silk is put, as for example when it serves as a drop-line on which they are able to retrace their steps to a certain spot; or as a balloon, in the case of the young spiders which are blown on their gossamer floats for long distances from the maternal home.

Spiders are entirely carnivorous, some being nocturnal, some diurnal hunters; some lie cunningly concealed, often exhibiting the phenomenon of "protective resemblance," or similarity to the objects round them, thus avoiding their own captors as well; others have swift movements and keen sight, while others rely upon their webs to effect the first stages of capturing.

Birds and lizards and other reptiles prey upon spiders, but their worst and most deadly enemies are the mason-wasps and *Ichneumonidae*. These insects do not attack ants, ladybirds or snails, and it is no doubt due to this fact that spiders often "mimic" (exhibiting the phenomenon of protective mimicry) ants, ladybirds and snails. Also due to this persecution is the adoption of an aquatic life by certain spiders.

If one is about to roam over a section of the mountain-side, such as at Kirstenbosch, and if one is prepared to give more attention to spiders than to complain if a web is accidentally encountered, it will be noticed that spiders are found on the ground, on flowers, on bushes and grass, and on trees. Then on seeing one and knowing that it is safe to handle it you may ask what it is. The following brief outlines will serve to identify the Family and Genus, the order adopted not being one of zoological sequence, but an approximate grouping of spiders found on the ground, on grass, bushes, and trees respectively. The Family can easily be recognised at a glance, but the Genus requires minute examination, often with the aid of a hand-lens.

AVICULARIIDAE.—In this Family (including baviaan and trap-door spiders) two or three genera are likely to be noticed, as follows:—

1. HARPACTIRA.—A large hairy spider, found in open silk-lined burrows on the ground, or in silk-lined nests under large stones where it lies in wait for its prey. Usually almost black in colour in the Cape and with a body ranging up to 2 inches in length and a diagonal leg-span up to 4½ inches. The chelicera or fangs are large and strike in a vertical plane. (In the majority of Families the fangs work horizontally.) The eyes, eight in number, are placed in two curved rows on a small tubercle on the anterior portion of the carapace, above the bases of the chelicera. There is a short straight horizontal groove about the centre of the carapace. The abdomen has 4 light brown lung-plates on the under-surface, and 2 moderately long and 2 smaller spinnerets posteriorly. The legs are furnished with velvet-like pads or scopulae at the extremities. The species usually found is *Harpactira atra* (black robber or snatcher).

2. SPIROCTENUS.—A moderately large spider, total body length about an inch, diagonal leg-span nearly 2 inches, body hairless, legs lightly clothed with hairs and with only small velvet-like scopulae at the extremities, carapace and legs yellowish brown, upper surface of abdomen mottled black and pale yellow; chelicera, eyes, carapace groove, and lung-plates as in Harpactira. *Spiroctenus collinus*, the species usually seen, lives in silk-lined tubes in the ground which it excavates with great patience. The aperture is not closed with a lid, but is fringed around with a turret of sticks and leaves woven together. These turrets are often to be seen during a walk, but the spider is rarely found unless the burrow is dug open.

3. MOGGRIDGEA.—Smaller than Spiroctenus, with the carapace and legs pale brown, abdomen dark with purplish tinge (often entire specimen with dull green tinge), anterior legs stout and strongly spined, otherwise legs with few hairs but with numerous stout bristles, no scopular pads usually apparent, eyes not grouped close together on a tubercle as in Harpactira and Spiroctenus, but forming 2 backwardly curved rows of which the anterior one is wider and larger, groove in centre of carapace curved backwards, chelicera in vertical plane, 4 lung operculae, 2 pairs of spinnerets posteriorly—one pair short and stout and the other pair very small and inconspicuous. One species, *M. terricola*, lives in mossy banks and grounds, constructing tubes in the soil and fitting them with lids which assimilate so well with the surroundings that they are often discovered only by the chance of an old nest having its lid open; when closed inhabited nests are usually found in the vicinity. Another species, *M. quercina*, constructs silk tubes in crevices of the bark of oak trees and fits the retreat with a lid, weaving bits of bark and lichen into the whole fabric so that it is only discernible by practice and close search or by the accident of an open lid.

Leaving the tube-dwellers one comes across several other different forms of ground-spiders if one rolls over fallen logs or lifts up large flat stones. The Families that are thus brought to light are usually Eresidae, Drassidae, Palpimanidae, Theridiidae and Clubionidae.

ERESIDAE.—Two genera, Eresus and Dresserus, are found under stones—alike in form and colour, but can be distinguished if examined with a good hand-lens. A ground Eresid can be recognised by its form and colour, its web and sluggish behaviour. In form they are somewhat oblong in the anterior portion, or carapace, and oval in the abdomen, the latter portion overlapping the former. The carapace is reddish black in colour, the abdomen olivaceous black, legs short and thick and usually drawn close to the body. The whole spider is covered with short silky hairs, which give it a dull velvety appearance. A close white web-tube is spun on the underside of stones, and, if such a tube be gradually torn open, the spider will passively come to light, and remain apparently inert. In both genera the fangs work in a horizontal plane, and there are 8 eyes. The genera may be distinguished as follows:—

1. ERESUS.—Dorsal sufarce of abdomen with a line of muscle-scars down each side, anterior pairs widely separated, white cribellum situated anteriorly to spinnerets on under-surface

divided into two sections only. A species usually seen is *E. fumosus*.

2. DRESSERUS.—Anterior pair of muscle-scars on abdomen close together, cribellal plate divided into four sections. *D. collinus* is among the commoner species.

3. STEGOCLYPHUS, found on trees and bushes, building central nests, in which usually a large number of spiders live together, and surrounding these an irregular web is spun. This gregarious habit alone is enough to identify them. In appearance they are smallish light orange and yellowish grey spiders, the cribellum divided into two sections, and the 8 eyes are arranged on the same plan as those of Eresus and Dresserus. They are active in their movements. *S. dumicola* may be seen at Kirstenbosch.

DRASSIDAE.—Spiders of the Family are fairly common under stones and logs in certain localities, but they are small and very agile and so it is difficult to capture without damaging them. Further the distinguishing characters are not obvious without a microscope. Generally they are small, sombre-coloured spiders—sometimes jet-black or ranging from grey to light brown. Species of Xerophanes are usually found in a web or silken retreat under stones, while in Prosthesina, Theuma and Platyoides they run free.

PALPIMANIDAE.—Members of this Family are occasionally met with under stones. They are sluggish in movement, and usually remain still when the stone is lifted. Dull red anteriorly (carapace and legs) with the abdomen pale yellow, or in some cases with dark marking, they can be recognised at once by the somewhat elongated and enlarged front legs which also in some cases bear tufts or pads of black hair on the terminal segments. A small Cape species with light and dark longitudinally banded abdomen is *Diaphrocellus biplagiatus*.

PHOLCIDAE.—Of this Family one member, Pholcus phalangioides, is often found in dark corners of rooms, boxes, etc., and in similar places out in the open. Usually it is known as "daddy-long-legs" on account of its very long legs, which are bent somewhat M-shaped, with a small body at the end of the M. They usually spin irregular webs, and when touched vibrate rapidly on their long legs until they look like a mere blur. If that doesn't work they can run away with fair rapidity.

CLUBIONIDAE.—Certain members of this Family are found under stones and can only be distinguished from the pale-coloured Drassids by microscopical examination. An exception, however, is the flat spider, Sclerops, which one often sees clinging to the undersurface of stones and which vanishes like a flash to the other side of the stone as soon as it is discovered. This astonishing rapidity makes it difficult to capture, because unless one pins it down by the body it simply parts with the two or three legs that one may imprison, and speedily decamps on the remainder. It is speckled and banded grey in colour with long outstretched legs and a body about the size of a threepenny piece.

Another Clubionid is a species of Palystes, a fairly large dark greyish brown spider with long strong legs, which can be seen running on the walls of rooms, particularly at evening time, when usually a commotion ensues and the spider is hunted and slain with a slipper. Were it known that its occupation is chasing and killing flies and mosquitoes which have settled on the walls in dark corners preparatory to making the night a misery, the slipper might not be so much in evidence. It is not a true house-spider but lives usually among plants out of doors and there builds its nest of dried leaves, spun round with a film of fine white silk, and suspended by silken cables in some flower-decked bower.

THERIDIIDAE.—These have too bad a reputation to be allowed to pass without a word. They are found under stones, in bushes and fallen leaves, and in corners of outhouses, etc. The former kind are black with white or orange-red spots and marks on the abdomen and a similarly coloured flash on the under-surface. The abdomen is almost globular in shape and much larger than the carapace, which is shiny black, and the legs are long and shiny black. The outhouse species is usually found in corners in a coarse silken tube which opens out into and is lost amongst an irregular network of threads filling in the said corner. The nest is a small white sphere. It is light mottled brown as regards legs and anterior portion, and dull white banded and streaked irregularly with black and orange on posterior portion. The colour, however, is very variable, and sometimes the black and sometimes the white medium prevails. It belongs to the genus Lathrodectus, which has a bad reputation for being fatally poisonous—not only in this country but in most others. The stigma, however, is attached almost solely to the black species with or without red spots, the variegated one, *L. geometricus*, previously mentioned being held innocent. The least that can be said, however, is that the case is not proven, and the reputation appears to be grounded mainly on the symbolical black and red colouring—which is unfortunate for the spider.

LYCOSIDAE.—Known also as "wolf" or hunting-spiders these make no web but rely upon their speed on the ground to capture prey, and are to be found among leaves, etc., and sometimes under stones. In appearance they are medium sized to small, brownish grey with light and dark longitudinal marks on the carapace and with a variegated or speckled abdomen Certain genera of Lycosids are able to skate over the surface of ponds and if necessary to submerge themselves; others construct tubes in the ground after the fashion of Spiroctenus and build round them a turret of sticks. They all have one peculiarity which at certain times of the year enables one to recognise them, and that is the habit of carrying the cocoon of eggs in the shape of a little white ball attached to the spinnerets. This habit is occasionally shared by the Pisauridae, which are found in similar habitats to Lycosidae—also running on the surface of ponds and plunging under water for their prey.

ALTIDAE.—In appearance the Cape species are small and sombre-coloured—being greyish brown or black, sometimes with spots and stripes—and at once can be recognised, as they skip about sunny walls or roam over leaves and the bark of trees, by their jumping powers. Whilst one is watching it or if one attempts to catch it the spider will jump or execute a series of jumps according to the ideas which it has at the time. Four of the eyes are on the vertical front of the carapace, the centre pair being very large and circular, and often appearing to smoulder with a greenish fire. The four other eyes are placed on the top of the head and far apart from one another. The legs are short and robust, the fore-legs being usually the strongest.

THOMISIDAE.—These curious spiders are found everywhere on bushes, flowers, grass, trees and fallen leaves—in most cases matching in colour their surroundings. Thus one finds them yellow, white, pink and red, green and red, brown, grey and so on. They do not spin webs but rely on the assimilation of their colour to the spot in which they are lying in wait to enable them to seize unwary insects. They are easily recognisable—being small to medium-sized, somewhat flat and broad, the legs directed laterally, with the anterior pairs longer and stouter than the posterior pairs. The appearance of the spider in walking is somewhat similar to that of a crab, and in consequence they are often known as "crab-spiders," although the sideways method of locomotion is no more frequent with them than the forwards or backwards movement. In the genus Thomisus (the white, pale yellow, or red and pink spiders found in flowers) the eyes are set in 2 broad distinct rows, are small, round and black, the lateral anterior eyes being at the bases of small projecting tubercles.

The brightly coloured dark green and red spider with no eye-tubercles, and with two conspicuous white spots on the anterior portion of the abdomen, is Synaema. A spider of similar shape but of a sombre brownish grey with very spiny anterior legs is Xysticus, while a pale-coloured longer-legged and longer-bodied form with a short dark band down the centre of anterior portion of abdomen is Philodromus.

OXYOPIDAE.—These are yellowish or green with long legs bearing fairly numerous stiff black bristles, and have the abdomen tapering posteriorly. They are found in long grass and flowers, etc.

AGELENIDAE.—Of this Family the genus Agelena is common at Kirstenbosch. The web is a sheet of close-textured fabric spread over the ground in the lee of a stone or at the roots of a bush or tuft of grass, and gradually narrows, converging to a funnel-like hollow leading down into a silken tube which runs under the stones or roots of the bushes, etc. In this tube the spider patiently waits for insects to settle on the sheet of web and then pounces upon them. Agelena is very difficult to capture on account of its speed.

Other Agelenidae are Argyroneta (or silver swimmer) and Desis. The former, found in pools and vleis, lives under water, weaving for itself a bell of silk which it fills with air brought down a bubble at a time from above. It is very shy, however, and great patience is required to see them at work or to see them entering or leaving their little diving bells. Desis lives in the sea, and can readily be obtained by breaking up lumps of "coral"—really serpulid worm-tube—from the low-tide belt at Muizenberg and vicinity. In the deserted tubes of this rock it lives weaving a silken retreat which it fills with air.

ARGIOPIDAE. This family embraces the majority of orb and net web-spinners, and in consequence is very much in evidence. Its members, too, are so frequently seen that to most people a spider is the spinner of a web in the garden and so an Argiopid. It is true that the Family is a very large one and the genera and species seem to be without end, since, owing to their visible and sedentary habits they are the most frequently collected of all the spiders. The species most in evidence is the yellow and black banded orb-spinner, *Argiope clathrata*, which is regarded as a variety of *A. lobata*, an exceedingly widely distributed species. Its web is often decorated by radial white bands, symmetrical and pleasing in appearance, known as stobilimenta, and the spider apparently uses the silk as a reserve store to enmesh insects in danger of escaping from the web. All through the long summer days she is poised, head downwards and legs outstretched, in the centre of her web. Should a wasp or other dread enemy appear she will quickly let herself down on a thread and lie motionless in the thick herbage for a time. In the autumn she builds a greenish silken bag to hold the cocoon of eggs and attaches it to twigs in some sheltered corner. This work accomplished, she shrivels up and dies.

Other genera which may be noted are—Argyroepeira, with a silvery abdomen marked with deep red or chocolate colour and green; Nemoscolus, with the abdomen dull silvery mottled and streaked with darker markings, living in little cornucopia constructed of small pieces of leaf and twigs woven into a fabric and hung in bushes, the entrance facing downwards; Gasteracantha, with the pale yellow dark-spotted abdomen much larger than the dark cephalothorax and somewhat flattened above, bearing thorn-like projections posteriorly and sometimes anteriorly and laterally; Nephela, recognisable by its large size, cylindrical abdomen, long banded legs sometimes furnished with tufts of bristly hairs, cephalothorax black above, bright yellow or red below, abdomen ornamented with white or yellow bands often broken up into spots, and having webs stretched between trees and bushes which are unmistakable for their size and strength; Caerostris, found particularly in damp places, squat and broad, with a large abdomen (usually at least as long as broad and produced into blunt warts or tubercles), dull grey and brown above and mottled so as to be almost inivisible on the bark of trees, under surface almost black, sometimes relieved by white or orange spots, and having a large vertical symmetrical web; Tetragnatha, found on grass and reeds near water, with very long legs, a long narrow body, and large curved toothed chelicera, of an almost uniform dull brown; Cyrtophora, medium-sized, with banded legs, dark cephalothorax with light vertical markings and a much larger abdomen, produced laterally and anteriorly into slight tubercles, and marbled black and white, having a web which is unique, composed of a horizontal finely woven net, still preserving traces of orb-formation, and supported above and below by a large irregular network of threads. Often the egg-cocoons are suspended chaplet-fashion vertically above the centre of the horizontal sheet, and the spider may be found in a silken nest alongside of the cocoons, from which she watches the web below.

This rapid survey of the spiders likely to be seen when roaming about the Cape, and Table Mountain in particular, will it is hoped enable people to recognise some of these harmless and interesting creatures. If any spider is found which does not seem to fit in, or about which more information is required, the necessary details will be supplied by the South African Museum. It is desirable that enquirers should contribute also by noticing the web-structure, locality and habits of the specimen which must accompany the enquiry.

R. W. E. Tucker.

The Collection of Specimens for Kirstenbosch.

MEMBERS of the Society are invited to assist in stocking the Gardens with native plants. Specimens from all parts of Africa are desired. At present representatives of the following are particularly needed: *Aloes, Bulbs, Ferns, Proteas* (seeds), *Heaths* (branches bearing old flowers), *Succulents, Woody Leguminosae,* medicinal, aromatic and other economic plants.

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INSTRUCTIONS FOR PACKING AND SENDING SPECIMENS.

Cotyledons, Crassulas, Euphorbias, Aloes, Stapelias, Mesembrianthema and other plants of a like succulent nature, and also the *Epiphytic Orchids,* should be packed dry. Each species should be wrapped in paper and laid tightly in a box. Large specimens of *Aloes, Euphorbias, Cycads,* etc., may be trucked loose.

Large specimens of Tree Ferns should be bound in wet grass or canvas, or with a little damp moss inside the canvas, and the stems should be strengthened with poles.

Ferns, Bulbous and Tuberous Plants in growth and flower need a little damp moss among the roots.

Distinct species of dormant bulbs and tubers, as well as of seeds, should be sent in separate wrappers.

Each consignment should bear (1) the name and address of the sender; (2) the locality in which the specimens have been gathered. Brief notes as to habitat (wet, dry, sun, shade, sand, clay, and so on) are most valuable.

Contributors of economic plants are requested to send particulars as to their properties and the methods of using them.

Common as well as rare species will be welcome. Fully addressed labels can be had on application.

The Botanical Society of South Africa

OBJECTIVES

(a) To maintain the Herbarium at Kirstenbosch, Cape Town, as part of the National Botanical Gardens of South Africa, and to develop it as a reference collection for research workers and as a museum display of the country's flora.

(b) To maintain the Garden at Kirstenbosch as a living museum of the country's flora, and to develop it as a centre for research and education.

(c) To organize classes of instruction in Botany for the general public, and to encourage the study of Botany in Schools and Universities.

(d) To enlighten and interest the general public in the wonders of the country's flora, and to encourage measures for the conservation of its natural vegetation and for the establishment of reserves.

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Honorary Members may be elected at a Meeting of the Society.

Those wishing to become members of the Society are invited to communicate with the Hon. Secretary, P.O. Box 30, Cape Town.

THE JOURNAL OF THE BOTANICAL SOCIETY OF SOUTH AFRICA

Edited by R. H. COMPTON, M.A.,
:: :: :: Hon. Director, :: :: ::
NATIONAL BOTANIC GARDENS
:: :: :: KIRSTENBOSCH :: :: ::

Part VII. 1921



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The Journal of the Botanical Society of South Africa.

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South African Proteaceae. By Miss M. M. Page.

NOTES AND NEWS.

The Botanical Society now numbers 55 Life Members, 47 Family Members, 419 Ordinary Members, and 258 Associates. Total 779. These figures show an increase in each class of membership, the total as recorded in last year's JOURNAL being 654. A further increase is greatly to be desired, and Members are earnestly asked to do what they can to interest their friends in Kirstenbosch and to secure their support. It is also hoped that many Associates, who enjoy practically all the privileges of full Members, will see their way to exchange associateship for membership.

* * *

Will Members and Associates who have changed their addresses kindly inform the Honorary Secretary, in order to ensure the receipt of the Journal and other publications? The Honorary Secretary would also be glad to receive corrections of any errors or misdescriptions which may unfortunately occur in the Membership Roll.

* * *

Part VI. (1920) of the JOURNAL OF THE BOTANICAL SOCIETY was published in December. It has been thought desirable to issue the JOURNAL earlier in the year, and the present Part will, it is hoped, appear in July. In 1922 and subsequent years it is proposed to publish the JOURNAL in March.

* * *

Two of the Informal Gatherings of Members of the Botanical Society have so far been held at Kirstenbosch this year, on February 12th and May 7th. Parties were conducted round the Gardens and progress pointed out: and on the latter date the Curator gave a practical demonstration of seed-sowing to an audience of about seventy-five people. One more of these gatherings will be held during this year at a date to be announced, in addition to the Annual At Home.

* * *

It is with the greatest regret that we record the death of Mrs. Brown Lawrence, which took place in England on the 4th June, 1921. Mrs. Brown Lawrence was a Life Member of the Botanical Society and a member of its Council from the outset. A regular attendant at the Council's meetings and an enthusiastic supporter of and worker for Kirstenbosch, her loss will be sadly felt in this as in other spheres of work.

* * *

Sir Harry Waechter, Baronet, C.M.G., who has recently purchased large estates near Salisbury, Rhodesia, has given a donation of £200 to the general funds of the National Botanic Gardens, and has promised two similar donations at yearly intervals. Sir Harry Waechter on his arrival from England was greatly impressed with the possibilities of the Gardens and with the inadequacy of their resources, and made his generous offer in the hope that his example would be followed by other benefactors. Needless to say, the gift was most opportune and welcome, and the example is admirable. It is greatly to be hoped that on his return from a visit to England in December, it will be possible to tell him of other similar donations inspired by his.

* * *

For those who hesitate to give money to Kirstenbosch there is a large opportunity for gifts in kind. Donations such as the following will be greatly welcomed, and would-be benefactors are asked to communicate with the Director: a tea-house, a bridge for the Oak Avenue, a slave-bell, a mowing machine, a display map of the Gardens, an engraved panorama plate, and various books.

* * *

Four of the Workmen's Cottages are still occupied as a Women's Hostel, the construction of the Pearson Memorial Hostel not having yet been begun. Cottage No. 5 has been furnished and is occupied by the Assistant Gardeners.

* * *

We publish a list of the seeds that are available for distribution from the National Botanic Gardens to Members and Associates of the Botanical Society, and to Botanic Gardens and similar public institutions in South Africa and elsewhere. Applications should be sent in writing to the Director. The amount of seed available is in many instances small, and a supply cannot therefore be guaranteed: applicants are urged to be modest in their requests.

* * *

Members of the Botanical Society who are desirous of making an experimental culture of the true English Black Peppermint—a plant of great economic importance as a source of peppermint oil and menthol—can obtain roots on application to the Director of the National Botanic Gardens. The plants will be supplied free of cost to members on the understanding that a brief report is sent later as to the conditions under which the plants are grown and the degree of success obtained. An abundant supply of moisture in the soil is necessary for the cultivation of Peppermint, and in dry districts or situations irrigation will be required. A light sandy soil, well manured, appears to be suitable, but experiments in other classes of soil are desirable.

* * *

One of the rarest and most curious of our native plants has recently flowered at Kirstenbosch. This is *Mystropetalum Thomii*, a member of the Balanophoraceae. Like other plants of this family, Mystropetalum is a total parasite, the host plants being species of Protea. Beneath the soil is a tuberous swelling attached to the roots of the host-plant, and composed partly of the tissues of the host, partly of those of the parasite. From this rise the inflorescences, which are stout spikes, reaching a foot in height, and densely covered with the tawny yellow and red flowers. The plant is devoid of chlorophyll and is thus dependent for organic food on its host.

The flowers are visited by flies (Musca sp.) and bees and the seeds are distributed by ants. The Kirstenbosch plants were grown from seed sent in by Mr. Prentice in 1915, the host plant being *Protea obtusifolia* (in the Protea Garden). In May this year the inflorescences covered about four square feet of ground around the base of the Protea bush. It is thought to be the first time a member of the Balanophoraceae has been successfully cultivated.

* * *

With the inauguration of a Heath Garden at Kirstenbosch it is specially desired to obtain seeds of the many exquisitely beautiful Heaths in which the South-Western region of the Cape Province abounds. The seeds are very minute and are generally shed before the fall of the withered flower. The best method of collection therefore is to put a whole branch, with dead flowers, upside down into a paper bag and hang it up to dry: when the seeds have been shed into the bag they may be packeted.

* * *

In the March, 1921, number of the *Journal of the Department of Agriculture* will be found an article by Professor Compton and Mr. Mathews on *The Cultivation of Buchu.* This has also been issued as a reprint—National Botanic Gardens, Economic Bulletin No. 1—and copies, either in English or Afrikaans, may be obtained on application to the Director.

* * *

In *S.A. Gardening and Country Life* a series of photographs of *Native Plants at the National Botanic Gardens* has been published month by month, accompanied by notes on their cultivation, etc. It is hoped to continue this series, which is a means of introducing and popularising native plants among South African gardeners, and thanks are due to the Editor of this excellent periodical for his co-operation in the matter.

The monthly "Kirstenbosch Notes" have also appeared regularly in the *Cape Times,* and serve as a brief guide to the principal objects of current interest in the Gardens.

* * *

We are glad to be able to publish in the present number of the JOURNAL a valuable article by Mr. A. R. E. Walker on the Geology of Kirstenbosch. All the great geological formations of the South-West and South Coast of the Cape are represented in Kirstenbosch, and there are areas of all the more important types of soil. Mr. Walker's article will enable many to perceive the fundamental relations between the geological formations on the one hand and the landscape, native vegetation, distribution of soils, fertility, etc., on the other.

* * *

One of the most important functions of Kirstenbosch is that of a Nature Reserve; and while the pines and poplars and other exotics may legitimately be cleared, little by little, to make room for extension of the Gardens, the native and largely unspoiled vegetation, forest, woodland and scrub should remain inviolate. These wild parts of the estate are the haunts of a large native fauna, which is as worthy of preservation as the flora. The series of articles appearing in this JOURNAL is intended to help nature students, residents and visitors to see and appreciate this fauna. In the present issue will be found an account of the Mammals: the Spiders were dealt with in Part VI. and the Birds in Part V.

* * *

The idea of Native Gardening is a fertile one, and there is arising a whole crop of private gardens which their owners affectionately dub "Little Kirstenbosch." In this JOURNAL Miss Edwards gives an account of the Native Garden and Reserve at Roedean School, in which she has taken so large a part. What has been done at Roedean could well be done at many other schools throughout the Union. Even in the most arid climates South African plants can be made to flourish and to yield recreation and interest to all concerned. We strongly commend Miss Edwards' article to the notice of principals and science teachers. Kirstenbosch will be glad to help in any similar enterprises which may be made.

* * *

If there is one group of plants more than another which has been successfully cultivated at Kirstenbosch it is the Proteaceae. It is estimated that nearly 2,000 specimens are now growing in the Protea Garden, practically all of which have been raised from seed in the Nursery. The great majority of these are flourishing admirably, and during the winter and spring no visitor should omit to see the collection, which is unique in the public and private gardens of the world.

* * *

In the present JOURNAL we publish an article by Mrs. Bolus on the botanical features of the Proteaceae, which will be useful to students and teachers; and also an article on the cultivation of the group by Mr. Mathews, which will be valuable to the growing number of gardeners interested in native plants. Reference may also be made to an illustrated paper by Dr. Phillips in Part III. (1917) of this JOURNAL.

* * *

At present the two Proteaceous genera Protea and Leucadendron are well represented in the Protea Garden at Kirstenbosch. Contributors are specially requested to send seed of the *other* genera of Proteaceae, which are more difficult to collect and which are as yet inadequately represented in the Garden.

* * *

The plate illustrating the article on Proteaceae in the JOURNAL is from drawings by Miss M. M. Page, Botanical Artist to the Bolus Herbarium, University of Cape Town.

Miss Page's *Eastward View From Table Mountain"*—the panorama as seen from the Contour Path above Kirstenbosch, and published in Part V. of this JOURNAL,—can be obtained separately on application to the Secretary, National Botanic Gardens, enclosing one shilling and sevenpence.

The Provincial Government is engaged on the construction of the road leading from the top of Kirstenbosch Hill to Constantia Nek. When completed this will place the Gardens on the direct "Round-the-Mountain" route, and a great increase in the amount of traffic and number of visitors may be expected.

* * *

Visitors bent on picknicking in Kirstenbosch now have the convenience of a stone fire-place (near the old Homestead ruins). It is hoped, moreover, that this may help to check the promiscuous lighting of fires in other parts of the grounds.

* * *

On fine public holidays about a thousand persons may be expected to visit Kirstenbosch. The number counted at the gates on the August holiday last year was 1131, on Wiener's Day 989, on Boxing Day 1,015 and on Union Day this year 949.

* * *

The Cape Town Branch of the South African Biological Society and the Mountain Club have arranged a Saturday Afternoon Ramble at Kirstenbosch on September 17th, which is open to the public. The guides will be Mrs. Bolus, Professor Compton and Mr. R. W. E. Tucker.

* * *

Kirstenbosch has enjoyed the most delightful spring and summer that could be imagined, and the weather has been admirable from the gardening point of view. Welcome rains fell throughout the warm weather, and the seven "dry" months, October to April, achieved a total of 18.89 inches. Even January had 1.86 inches, February 1.99, March 1.47, and April 3.77. The Gardens were green the whole summer, and plants from Natal, Transvaal and other summer-rainfall districts were specially benefited and made excellent growth. On eight days only did the temperature exceed 90°, the maximum being 97.8° on February 24th. Taking the statistics for 1920 as a whole, the total rainfall was 70.86 inches: the lowest temperature 41.8° (August 12th) and the highest 91.8° (February 16th).

PROGRESS AT KIRSTENBOSCH.

THE following summary of the principal work done in the Gardens from the last issue (December, 1920) to date is recorded for the information of those members of the Society who are unable to keep themselves acquainted with the progress by frequent visits to Kirstenbosch.

The Pelargonium Garden has been filled up to its proposed levels, and the through path (50 yards long by 4 feet wide) has been kerbed and cobbled with stones.

The corresponding path in the Daisy Garden (48 yards by 4 feet) has been completed, as also the parallel path (63 yards long by 8 feet wide) to Nursery Stream. Eleven stone steps have been fixed where required on these paths and a solid effect secured by the insertion of boulders at their sides. The banks of the stream have been filled in and ornamented with boulder stones. On the road side the kerbing and guttering (33 yards) have been laid, completing the circuit of this area. The area has been filled up to its levels with soil obtained from excavation on the road round the Aloe Kopje.

Near the Rustic Bridge a portion of the area lying between the Aloe Kopje and the Fern Dell has been cleared, trenched, and filled in to levels. Of the intervening paths 127 yards have been kerbed, 101 yards guttered, and 60 yards of foundation laid and the surface blinded with gravel. The filling in on the main path to the Bath is being done.

The remaining sections of the Circular Drive (332 yards) round by the Ruins and Terrace are nearing completion, short lengths of half the width only requiring the blinding to be fit for use. The first half-width has been available for traffic for some months. Much of the material required here and on other sites for filling up has been obtained from excavation on the road round the Aloe Kopje.

The line of the drive from the Cape Town Entrance to join up with the Circular Drive at the Ruins, and the proposed "Park" for cars, has been pegged out and cleared of trees and scrub.

The restoration of the Silver Tree Forest is being aided by the removal of Pines, Wattles and scrub, and a young generation of silver trees is being preserved thereby.

Pathways have been more clearly defined in the Protea Garden by the removal of bush, etc.

The Contour Path has been re-cut and re-graded, and the sides cleared of scrub to form an effective fire-belt. A new section has been cut from the crossing at Nursery Stream to the Wynberg Gate affording readier access to the stretches above. The total length dealt with approximates two miles, leaving a section from a point north-east of the Tree Ferns or Celtis Glade to the proposed Cape Town Entrance to be completed.

The fire-belts on Bishop's Court, Hohenhort, Cecilia, and Fernwood boundaries have been made effective, as also along the Klassenbosch Valley Road.

Two huts have been erected of spars and reeds for the accommodation of native labourers. Stone Fire-places and Lavatories have been erected near the Ruins for the use of Visitors.

Gutters have been laid, and spar fences erected enclosing garden ground at the Hostel Cottages.

Approximately 11 of the shortest rows of Buchu have yielded 473 lbs. of dried leaves. The plantation has been further extended by the sowing *in situ* of 33 rows eighteen inches apart of *Barosma betulina* and 11 rows of *B. crenulata*.

Preparation of ground for the extension of the stands of Hops, Kudzu, and Peppermint, and for the formation of stands of numerous standard economic plants has been started.

A beginning has also been made with the trenching of the upper part of the site for the Karroo Garden.

1st June, 1921. J. W. MATHEWS.

THE GEOLOGY OF KIRSTENBOSCH.

By A. R. E. WALKER, B.Sc., A.R.C.S.

IT is very probable that comparatively few of the numerous visitors to Kirstenbosch give more than a passing thought to the geology on which so many of its natural beauties are, to a large extent, dependent.

The object of this paper is to point out and explain the salient geological features of the area and so provide an additional interest in the gardens for those who, whilst possessing some knowledge of geology—possibly a general knowledge of that of the Cape Peninsula as a whole—have not thought to apply such to Kirstenbosch in particular.

For reasons which will be made apparent later, what is known as the solid geology of a small area, such as Kirstenbosch, is frequently more difficult to ascertain than the general geology of the larger area of which it forms a part. It might be pointed out here that a general knowledge of the geology of the Peninsula, although not absolutely essential, will prove extremely useful to anyone desirous of studying that of Kirstenbosch.

The scope of the present paper does not allow for the inclusion of a description of this larger area; a reference, however, to that given in "The Cape of Good Hope"—the official handbook of the Cape Town Corporation, dated 1911—will supply the essential information relative thereto.

Rock Débris.

Most of the nature lovers of the Cape Peninsula must have observed that the slopes of our mountains generally, and the lower slopes in particular, are frequently boulder-strewn, and are covered, not with soil alone, but with a loosely consolidated, heterogeneous material consisting of either a sandy or a clayey matrix enclosing angular rock fragments which exhibit great diversity both of form and of size, and the majority of which are of hard durable sandstone similar to the bedded sandstones forming the upper portions of the mountains. The names "detritus," "rock débris" or simply "débris" are used in a general way for this material.

They will also have noticed that practically the only surfaces not covered by such superficial detritus are the precipitous rock-faces so characteristic of the higher altitudes. Exposures of solid rock-formations "in situ" on the middle and lower slopes of the mountains from Devil's Peak (overlooking Rosebank) to Constantia, are comparatively few and far between.

The material comprising this débris is derived from exposures of solid rock-formations, principally by processes of mechanical disintegration. Its accumulation tends, therefore, to preserve from further mechanical disintegration the formations on which it rests. Moreover, whereas in the early stages of its accumulation, fragments of rock from the underlying formations will almost certainly be included—and will therefore serve as some indication of the nature of the latter,—during the later stages of accumulation, as the sources of fresh material are confined to exposures of rock at higher altitudes, the upper layers might eventually contain fragments of rock all of which are foreign to, and none of which will therefore serve to indicate the nature of, the underlying rock formations.

Further, since the upper mountain slopes are much steeper than the lower, and, in addition, since the tendency of movement of the detritus—under the action of gravity, the run-off of rain and the flowage of streams—is always a downward one, the thickest accumulations are generally found on the lower slopes.

Again, in areas characterised by the accumulation of detritus, the only places likely to furnish evidence of the underlying rocks are those such as stream courses, road-cuttings, pits and quarries, where it is liable to be cut through and the underlying rocks exposed, either by natural processes or through the agency of man.

Approach from Wynberg.

So far as the accumulation of surface detritus is concerned, Kirstenbosch is not an exception to the rule. Nestling as it does at the foot of a high, steep-sided mountain range, much of its solid geology is completely hidden under a covering of superficial material. On this account, anyone desirous of studying the geology of Kirstenbosch would be well advised to choose an approach to the locality along which evidence may be obtained of the geology in its immediate vicinity. Of the various approaches, that from Wynberg along the road which leads to the top of Wynberg Camp (Fifty-Eighth Avenue) and continues, with fair directness and easy gradient to Kirstenbosch, may be strongly recommended. At Fifty-Eighth Avenue, and in the neighbourhood thereof, there is convincing evidence that one is on a granite formation. Here are exposed "in situ" several fairly large masses of granite, resembling, in all essential details, that so plentifully exposed in Cape Town, at Sea Point and along the Victoria Road from Sea Point to Hout Bay. Reference might also be made here to the well-known "Hen and Chickens"—granite boulders occurring a little further over, in a northerly direction, from Fifty-Eighth Avenue.

The Granite.

Quite recently the military authorities have caused to be broken up for road-metal one of the boulders occurring in the vicinity of Fifty-Eighth Avenue. Much as this might be deplored on sentimental grounds, whilst the work of destruction was in progress one was enabled to make a much fuller examination of the rock than could have been made otherwise. It is markedly porphyritic; phenocrysts of a greyish-white, potash felspar (microline) occur in a holo-

crystalline groundmass of granitic texture consisting principally of quartz, greyish-white felspar and biotite mica. The felspar of the groundmass is in part potash and in part soda-lime (an acid plagioclase) felspar. The biotite mica is almost black in colour and can easily be flaked with the point of a knife; where it has undergone alteration it has a bronzed appearance. In addition to the above minerals, crystals of cordierite, rectangular in cross section on the broken surfaces of the rock, also occur; whilst some appear to be only slightly altered, the majority have apparently been more or less completely converted into pinite pseudomorphs. The latter retain the shape of the original cordierite, but, whereas cordierite is a hard mineral possessing a pale lilac-grey colour, the pinite is soft under the point of a knife and has a dirty-green appearance.

In addition, the rock inclusions so characteristic of the granite occurring throughout the Peninsula are present here also.

Decomposed Granite.

The occurrence of isolated boulders or groups of boulders such as these, is typical of the outcrop of granite in a country having a humid climate. Under such atmospheric conditions the rock is subjected more to chemical decay than to mechanical disintegration. The felspars become changed by hydration into hydrated silicate of alumina—a clay-like substance known as kaolin—whilst their potash, soda and lime contents are converted into soluble carbonates. The biotite also undergoes hydration, changing first to a bronze colour; it eventually breaks down to red or brown oxide of iron and thus furnishes colouring matter to the altered mass. The irregularly-shaped quartz individuals remain unaltered, intermingled with the clay formed from the felspars; their presence can be detected by the gritty feeling experienced when the clay is rubbed between the thumb and finger.

In a granite country it is generally possible to observe the rock in all stages of decomposition from slightly altered granite, which has the appearance of having been stained a pale yellow or yellowish-brown throughout and in which the felspars are generally quite opaque, through various degrees of "rotten" granite to a gritty, micaceous clay, somewhat mottled in appearance, the dominant colour of which varies from a pale yellow-brown or buff on the one hand to a somewhat darker brown or reddish-brown on the other.

It must be understood that the process of chemical decay is most effective where the surface of the rock is covered with soil supporting vegetation; bare rock-surfaces are not so rapidly attacked. On this account such a surface tends to become a hillock and thus might eventually develop, as a result of circum-denudation, into an isolated boulder. The material of decomposed granite is very prone to removal by rain, the effect of which is to quickly wear down the major irregularities of the surface so that, as a rule, granite outcrops generally give rise to rounded, and, for reasons given above, boulder-strewn areas.

Vegetation serves very largely to protect the products of decay against removal by rain; it tends to arrest such material undergoing transportation by this agency and, further, it gradually converts it into soil. Large thicknesses of the latter frequently rest on granite surfaces. This is observable in several places as one continues from Fifty-Eighth Avenue towards Kirstenbosch. The colour of the soil depends both on the chemical state of the iron compounds and the amount of humus present; it varies considerably though generally it is some shade of brown.

Granite boulders are again encountered close to the road at, and in the vicinity of, the gate bearing the sign "La Cote-aux-fées." It is about here also that one realises the fact that one has been walking along the flanks of a large spur-like off-shoot from the base of the mountain in the neighbourhood of Kirstenbosch.

The Landscape.

Continuing, one becomes increasingly impressed both by the grandeur of the mountain range ahead and the sylvan beauty of the Vale of Kirstenbosch lying at its foot below. Before descending into the valley it is advisable to ascend the mountain slopes, by the road leading to the Director's House, until a point of vantage is gained from which the whole of the surrounding country, from south, round through east to north, may be viewed. From such a point, a most extensive and magnificent view is obtained; it is, moreover, a panorama which is peculiarly fascinating to the geologist. Almost instantaneously with his vision he pictures, in fancy, the low-lying lands as an extensive sea with a broadly sweeping bay to the south—where now are Tokai and Constantia Vale—and a similar one to the north; the two divided by a granite spur which now stretches out into the plain a distance of from two to three miles. This "flight of fancy"—for as such it must be regarded until undoubted evidence in its support is brought to light—most probably mirrors, in a general way, the distribution of land and water some little time back in geological history. To-day, however, this granite ridge serves only to divide the streams flowing into False Bay from those which flow into Table Bay.

Returning to the junction of the roads on the crest of the ridge, one is able to observe the main topographical features of the valley portion of Kirstenbosch. This area, which has roughly the form of a horse-shoe, comprises practically the whole of the developed portion of the Gardens. The mountain—an imposing feature of which is the rocky buttress isolated by the Skeleton and Nursery Streams—constitutes the head of the valley, whilst the southern side is formed by the base of the Kirstenbosch-Wynberg ridge; a less conspicuous spur forms its northern limit. If one exclude the upper mountainous portion, the area may be likened to a tilted basin having a large piece broken out of one side—the eastern side—thus providing an outlet for the valley. The area below the junction of the Nursery and

Skeleton Streams represents the somewhat tilted bottom of the basin.

The Streams. The above-mentioned streams, together with their tributaries, constitute the principal drainage of the area. The Window Gorge Stream is singular in that it does not actually enter the valley but flows along the crest of the northern spur to beyond the limits of Kirstenbosch. Consideration should be given to the changing gradients of these stream courses. In general, from the source to about the height of the contour path, the slope is steep; at this point there is a precipitous drop. It will be observed that this cliff is a noticeable feature not only in the stream beds, but on the mountain slopes as well. Below it the stream courses are less steep; they gradually diminish in steepness the nearer they approach the bottom of the valley—say to where the two principal streams unite. From this point the gradient is comparatively low.

Another characteristic feature of the stream beds is, that they are largely packed with boulders varying considerably in size, the bulk of which show rounding due to wear and tear; the number and average size of these boulders tend to diminish with the diminishing gradients—noticeably so in the lower, or valley courses, where the gradients are small compared with those of the mountain courses.

The Rocks. The Cape Peninsula is almost entirely built up of three rock formations, all of which are represented at Kirstenbosch. These are: the mountain-building Table Mountain Sandstone Series, the Malmesbury Series and the Granite which is intrusive in the latter. Of these, the Malmesbury Series is the oldest; originally a thick, horizontal series of fine-grained, arenaceous and argillaceous sediments, since its formation it has been subjected, in turn, to severe folding—so that everywhere the beds are now steeply inclined to the horizontal,—to invasion by a molten magma which ultimately consolidated, as a result of slow cooling, into the somewhat coarsely crystalline rock known as granite, and, along with the granite so formed, to a period of extensive denudation during which both were worn down to a more or less level surface,—possibly a plain of marine erosion. On this surface the material of the Table Mountain Sandstone Series was laid down. At a later date all three formations were traversed by dykes of dolerite.

The T. M. S. Very nearly horizontally bedded sandstones belonging to the Table Mountain Sandstone Series form the upper portions of the mountains overlooking Kirstenbosch. They are for the most part thickly bedded, well jointed, white or light greenish grey in colour and even and fine grained in texture. Many exhibit "current" or "diagonal" bedding. Occasionally one comes across layers containing pebbles principally of white vein-quartz. The cementing material is siliceous in composition, hence the sandstones are hard and of a very durable nature; the term "quartzite" may be, and is, frequently applied to them. It is largely owing to the durability of its sandstones that the series builds up all the highly mountainous portions of the Peninsula; since, in addition, they are either horizontally bedded or only slightly inclined—so that their joint-planes are consequently either vertical or steeply inclined—its outcrop gives rise to a precipitous escarpment which lends itself to the formation of steep-sided ravines and outstanding buttresses. The Castle Rock which dominates the head of Kirstenbosch Vale is a good example of the latter.

Towards the base of the series the sandstones are dark red or purplish red in colour; they are more thinly bedded than the upper layers and many of them are of the nature of shaly sandstones or sandy shales. Fragments lying in the stream courses frequently show current bedding and sun-cracks; these features, together with the colour, are characteristic of shallow water formations.

Although the bulk of the sandstones of the Table Mountain Sandstone Series are of a very durable nature, they are by no means immune from processes of chemical decay. Apparently only the cementing material is subject to attack in this way. What the chemical changes are which take place have not yet been properly investigated. They lead, however, to the production of various shades of brown or red oxide of iron. These colours are frequently distributed in zones either parallel to joint planes or other fissures, or to the surfaces of boulders. Eventually the iron content appears to "leach out" entirely and a white friable sandstone remains; such sandstones readily disintegrate into white sand. Apparently, under certain conditions, well cemented sandstones may be converted "in situ" to white friable sandstones by this process of chemical decay.

Again, surfaces of the sandstone subjected to the ordinary processes of weathering, are not weathered uniformly throughout; this is called "differential weathering." Fantastically shaped blocks are often thus formed. The surfaces of such blocks frequently exhibit numerous cup-shaped hollows with interspersed knobby projections. It is interesting to note that these hollows tend to collect wind-transported dust and also to conserve rain water; many are, on this account, moss-lined. It should be pointed out here that the dominant grey colour of the Table Mountain Sandstone outcrop is mainly due, if not entirely so, to the growth of lichens on the rock surfaces.

The base of the series is not exposed as a rule; it is generally concealed by débris. At the confluence of Nursery and Diamond Streams, however, it is well exposed. Here the basal sandstones appear to be somewhat thickly bedded and can be seen lying on granite. Since the latter rock is much decomposed superficially, it is more readily eroded by stream action than the overlying sandstones; this erosion

has proceeded to such an extent that the latter have become "undercut" and a vertical cliff or escarpment has resulted, which in turn causes a waterfall.

Granite Foundation.

The granite is very similar to that already described, so that a further description is not deemed necessary. If the stream course be followed downwards it will be noticed that whilst granite boulders do occur they are much smaller in size and more completely rounded than those of sandstone; as a matter of fact they very quickly almost entirely disappear. The reasons for this are, firstly, that the granite, owing to its proneness to chemical decay, furnishes fewer fragments in the first place than the hard well-jointed sandstones, and secondly, any granite fragments which are produced cannot long survive the attrition to which they are subjected in a stream bed packed with hard sandstone and quartzite boulders.

Granite is plentifully exposed in Skeleton Ravine; the waterslide, for example, which occurs just above the contour path is a granite surface. In this stream course the junction between the two formations can be located to within two or three feet although it is not actually exposed. It is interesting to note that, whereas in Nursery Ravine the junction is some distance below the contour path—at about 800 feet above sea level to be precise—in Skeleton Ravine it is some considerable distance above it. The height of the contour path, where it crosses Skeleton Stream, is in the neighbourhood of 900 feet and the base of the sandstone occurs 100 feet or so above this again. These facts suggest the probable occurrence of a fault in, or along one side of, Skeleton Ravine.

Granite is also exposed in Window Ravine; no search was made here for the base of the sandstones.

Again, along the road leading to Constantia Nek, a fairly large quarry has been opened up in somewhat rotten granite occurring "in situ."

From the foregoing one may safely infer that, throughout the area of Kirstenbosch, the Table Mountain Sandstone Series rests on a granite surface.

The Malmesbury Series.

If one have access to a large scale geological map of the Cape Peninsula, one may observe that the general trend of the contact of the Granite and the Malmesbury Series is south-east from Sea Point. On the eastern side of Table Mountain, however, there is a change of direction shown, due to a southerly extension of the Malmesbury Series. The line of contact is mapped as crossing just within the north-eastern beacon of Kirstenbosch. The Granite occurs to the south, the Malmesbury Series to the north, of this line of contact. On this account it has generally been supposed that, except for a very small triangular portion at the north-eastern corner of Kirstenbosch, granite was the underlying rock formation throughout the whole of the area below the sandstones. It appears, however, that this southern extension of the Malmesbury Series is greater than is shown on the map, since a belt of very much decomposed beds belonging to the latter extends throughout the area from north to south, along the eastern margin, and crosses the Kirstenbosch-Wynberg granite ridge at the junction of the roads below the Director's house.

Before proceeding to describe this occurrence in detail, a few general remarks concerning the Malmesbury Series may not be out of place here. Originally fine-grained sediments, all somewhat argillaceous (clayey), many highly so, they have been steeply tilted and cleaved—that is, splitting directions other than those of bedding and jointing have been developed by pressure—so that they are frequently spoken of collectively as the Malmesbury Slates. Owing to the intrusion of a large molten magma—that from which the granite was formed—many were subjected to very great temperatures, which, in turn, produced further changes; these were principally changes in mineral composition owing to the development of new minerals, induced by heat, from the original materials of the slates. As a result of this, near the contact with the granite the beds are highly micaceous and spotted. The mica individuals, unlike those of the granite, are extremely small in size; the spots are due to the development of the mineral cordierite. The spotting shows very clearly on weathered surfaces. Near the contact the slates are frequently associated with fine-grained granite running in the form of tongue-like off-shoots from the main mass. At the contact there is a zone of "mixed rocks" owing to the "lit par lit" injection of the slates with granitic material.

The slates, since they possess several splitting directions and also on account of their mineral composition, are prone both to mechanical disintegration and to chemical decay respectively. Chemical decay produces a clay very similar in colour to that produced from granite. It has a much finer texture however than the latter since it does not contain either coarse quartz grains or large grains of incompletely altered felspar. When micaceous, the mica flakes are much smaller in size though more abundant than those occurring in granite clay.

Exposures of Malmesbury Slates.

At Kirstenbosch, the Malmesbury Series is best exposed in the upper portion of the area between the Deviation Road and the closed section of the Rhodes Road. For the most part it consists of very much decomposed spotted slates. As one approaches Kirstenbosch from Wynberg by the route previously described, it will be noticed that the stretch of road from the gateway of "La Côte-aux-fées" almost to the eastern boundary of Kirstenbosch has only a very slight fall; also, that, in the cutting along the upper side of the road, there are exposures of coarse, gritty clay resembling that formed from granite. Close to the boundary there is a noticeable increase in the amount of fall of the road and this is accompanied by a change in the nature of the material occurring by the road-side. Here one finds in the lower levels of the cutting a fine-grained,

compact, finely micaceous clay-like material the colour of which, when freshly fractured, is light brick-red. This is overlain by a bed of rubble several inches thick which in turn is covered by a greater thickness of finer-grained superficial material. It is interesting and instructive to notice in this road section, that the rubble bed fills up inequalities of the surface of the underlying clay and has, moreover, the same general slope as that of the land surface. At the junction of the roads very much decomposed rocks of the Malmesbury Series are exposed both in a small pit and in the bank where the Wynberg Road bends round into that which leads to Constantia Nek. It is very probable that the eastern contact of this belt of Malmesbury Slates with the granite is close to the spot where the change of gradient in the road takes place; it is impossible to say where the western line of contact occurs, or, in other words, how far this belt of slates extends in the direction of the mountain.

Quite good exposures occur both in shallow pits above the upper portion of Deviation Road and in the road cutting itself. Where the slates still retain their jointed structure they appear to be dipping very steeply (almost vertically) towards the mountain (west) and striking almost due north. In the road-cutting they are overlain by a rubble-bed similar to the one mentioned above which here also is succeeded by a greater thickness of finer superficial material. It appears from this that the rubble-bed and the overlying stratum are continuous deposits approximately parallel to the present-day surface of the ridge.

Near the Kirstenbosch boundary quartz veins occur "in situ" both in the slates—which are much broken up here, due, possibly, to "surface creep"—and, a little lower down, in a somewhat coarse, gritty and micaceous clay containing fragments of much decomposed fine-grained granite. This material extends some little distance and shows an irregular surface the hollows of which are filled with rubble comprising fragments of spotted slates, white vein quartz and fine-grained granite similar to that so frequently found in association with the slates near their contact with the main granite. This rubble, in turn, is covered with fine superficial material. Throughout the remaining portion of the road, as far as the bend, the cutting reveals thoroughly decomposed granite covered with rubble and fine detritus. Continuing down hill, it will be observed that the rubble bed rapidly increases in thickness, the while the fragments diminish in size, whilst the overlying deposit becomes darker red in colour, and, in general appearance, approximates more to the popular conception of soil than it did at higher levels. This red soil extends, with gradually increasing modification, along the lower slopes of the ridge in the direction of the mountain.

Exposures of spotted slates and veins of white quartz occur on the slopes between Rhodes Road and Deviation Road. In this area, where there is little or no covering of soil, the disintegration of the slates has produced a gravel which is generally fine-grained in texture and the colour of yellow ochre, and which consists of clay containing small fragments of vein-quartz and of decomposed slate.

Another interesting exposure of the Malmesbury Slates forms the left bank of the combined Nursery-Skeleton Stream (Liesbeek R.) just above the bridge under which it crosses Rhodes Road. Fine-grained granite outcrops close to the bridge; a few yards upstream there is a bend bordered by a cliff which has been carved out of the Malmesbury Slates during periods of flood. Here, although the slates are much altered, they still show traces of streakiness due to "lit par lit" injection of granitic material.

Reverting to the consideration of the western limit of this belt of slates, one might point out that the first indications of the occurrence of the granite to the west of it occur on the top side of Constantia Nek Road, at the second bend from the junction of the roads on the crest of the ridge. The contact is most probably at, or near, this spot. Again, two large granite boulders, both of which are most likely "in situ," occur on the slopes between the Chestnut Avenue and Window Gorge Stream, approximately to the north from a point about half-way up the Avenue.

The occurrence of the Bath spring has some bearing on this subject also; springs are known to occur elsewhere in the granite in the neighbourhood of its contact with the slates. It might be mentioned here that the Cycad Amphitheatre in the centre of which the Kirstenbosch spring is situated has no doubt been produced as the result of the slow but long-continued denudation of the surface by the spring itself.

It seems probable, then, that the western granite-slate contact runs across Kirstenbosch in a northerly direction somewhere in the neighbourhood of the Terrace.

Dolerite Intrusions.

Dolerite dykes are not of very common occurrence throughout the Peninsula; those which do occur were no doubt formed during the same period of intrusion, and, since some of them are seen to have intruded the Table Mountain Sandstone Series, all are regarded as being younger than the latter. One such dyke crosses the contour path near the top of the left bank of Nursery Ravine. The fresh rock is almost black in colour, fine-grained and compact in texture and generally exhibits a crust of rich yellow-brown material on weathered surfaces. The outcrop of this dyke may be followed upwards into the ravine towards the stream bed, but its continuation down the mountain slopes is only indicated by a narrow belt of dark brown soil containing occasional fragments of much decomposed dolerite. One gets the impression that the dyke dips steeply to the south and that it strikes in an east-south-easterly direction towards the Director's house. If such be the case, it should cross the Constantia Nek Road on the southern side of the Kirstenbosch-Wynberg ridge. It is significant that a dolerite dyke having such a strike has been mapped here. This was not observed in the road cutting

although rounded dolerite fragments were found in a layer of coarse rubble occurring here; possibly it will be exposed in the bed of the stream which has its source near the junction of the roads and flows in a southerly direction approximately parallel to, and on the low side of, the road.

Owing to the large number of convicts at present employed in reconstructing this road the examination of this portion of the Gardens was deferred.*

It is felt that little need be added to what has already been stated concerning detrital deposits. Those remarks apply in general to Kirstenbosch. The Mountain supplies the bulk of the material; the constant streams, torrential streams which occur only during periods of heavy rain, and rain itself, sort and transport it to lower levels. Fine sand and silt are transported and deposited further from the source than the coarser pebbles and boulders.

There are areas where large blocks fall from the sandstone escarpment on to slopes which are little affected by either constant or torrential streams; such, for example, is the Aloe Knoll, above Window Ravine.

The valley portion of Kirstenbosch has, as one would expect, a thick covering of fine material, known as soil. In the bottom of the valley—in the Economic Gardens particularly—the soil will be an admixture of material derived from all three rock formations; judging from its black colour it contains a large amount of humus and one would infer from it that this area was at one time the site of a swamp.

The red soil on the southern slopes of the valley has been largely derived from the Malmesbury Slates but will no doubt contain a large amount of granite sandstone material.

Uses of Material.

Although the geology of Kirstenbosch is quite of an ordinary nature, viewed from an economic standpoint, the natural resources have been so fully realised and also utilised to such an extent, that one cannot conclude without making some reference to them. As one would expect, those portions of the Gardens having thick coverings of good soil are under cultivation for special purposes.

Sandstone blocks and boulders have been split up and used as building stone for the Workmen's Cottages; they also provide excellent material for road foundations and macadam. The site of the sand-pits just above Rhodes Road, near the northern boundary, is probably a portion of an old stream bed, now filled in, in which rounded and sub-angular boulders of white friable sandstone occur embedded in white sand suitable for building purposes. Blocks and boulders of the purplish sandstones which occur towards the base of the Table Mountain Sandstone Series furnish excellent material for the construction of natural-looking rockeries; since the bedding planes are more pronounced in these sandstones than in the more thickly bedded varieties, blocks of this material are characterised by possessing two more or less parallel surfaces and thus they lend themselves to being "placed" in a rockery in a natural position; added to this, most of them are differentially weathered along the bedding planes and this imparts to them a peculiarly pleasing appearance. One should inspect the rockeries which have been constructed alongside the approach to the Bath, and, at the same time, observe what excellent footpaths the smaller sandstone boulders, or "cobbles" which occur in the stream courses make when properly laid and rammed.

The rotten granite, which fortunately occurs adjoining a locality where the surface is thickly strewn with sandstone blocks, is good both for binding macadam and for road surfaces.

The Malmesbury Slates yield, locally, a gravel which has proved very suitable for tennis courts and for the surface of roads and paths; several pits have been dug in this material on the slopes of the ridge below the upper portion of Deviation Road.

In conclusion, it should be understood that the above is only a general description of the geology of Kirstenbosch—the record of impressions got during two or three brief visits to the locality. No doubt much remains to be discovered by an enthusiastic and careful observer.

Geological Department,
University of Cape Town,
May, 1921.

[*Miss V. Rothkugel and I have traced this dolerite dyke crossing the Constantia Nek Road, a few yards south of the cross-roads on the crest, and for about 100 yards along the ridge practically in the line of the old overgrown track towards Wynberg which joins the main Wynberg road near the Hohenhort beacon.—*Editor.*]

SOME RECENT PUBLICATIONS.

THROUGH the kindness of Mr. Putterill, Government Mycologist at Cape Town, we have been able to see copies of *Bothalia,* Vol. I., part i, and of the first three parts of *The Flowering Plants of South Africa,* both edited by Dr. Pole Evans, Chief of the Division of Botany, Department of Agriculture. *Bothalia* is described as "A record of contributions from the National Herbarium, Union of South Africa, Pretoria," which is said now to "embrace all the more important private collections in the country." The first issue includes an article by Dr. Doidge on South African Ascomycetes, articles by Dr. Phillips on the genus Bersama and on the Natal Sapindaceae, and by Dr. Phillips in conjunction with Mr. Hutchinson of Kew on the African species of Sesbania. *The Flowering Plants of South Africa* is a quarterly periodical following the model of Curtis' *Botanical Magazine.* The subscription price is 62s. per annum, post free. Each part contains ten hand-coloured plates

(*Continued on page 28.*)

THE KARROO GARDEN AT WHITEHILLS.

THE Trustees of the National Botanic Gardens have recently adopted a scheme which will have the effect of notably enlarging their opportunities, if not their scope. As time goes on it becomes clearer that no better site could be found in the Union for the purpose of a National Botanic Gardens than Kirstenbosch, the warmly expressed views of Professor Pearson, Dr. Marloth and many other botanists of the first rank as to its eminent suitability being amply justified. The absence of frost, the generosity of its rainfall, the variety of its soils, the richness of its native vegetation, its climatic suitability for the cultivation of the plants of which South Africa is chiefly proud, its proximity to a great town, port, educational and health centre, and the magnificence of the landscape in which it is set all mark out Kirstenbosch as the ideal site. No other alternative site has ever been seriously suggested.

At the same time it must frankly be recognised that in a vast country like South Africa, no single locality can possibly fulfil all the varied demands that a Botanic Garden makes upon it: and because Kirstenbosch is superior to any other site that could be suggested for the general collection and cultivation of the South African flora, it must not be expected that *all* the various classes of plants will succeed there to the same degree of perfection. Kirstenbosch may be called a sort of House of Assembly for the South African flora, where are gathered representative plants of innumerable districts all over the Union. In addition to this, however, it is quite clear that there should be local gardens, each situated in and representative of a particular climatic area. In such a local garden a more intensive "collection, preservation and study" of the local flora would be possible: climatic problems would solve themselves, and the plants would grow in forms more closely similar to that which they adopt in their natural homes.

It has long been felt that one of the most urgent needs in this direction has been the establishment of what may briefly be called a Karroo Garden. The reasons which have weighed with those who have advocated this are as follows:—

(a) The enormous area of country in South Africa under arid climatic conditions; the Karroo Plateaus proper being said to have an area of more than 100,000 square miles, to say nothing of other similar climatic areas.

(b) The astonishing native flora of these arid districts, not suspected by the railway traveller who casts a casual eye over their endless plains and kopjes. This is the region of the richest development of succulents in the entire world. No other area, not even the Southern United States of America with their Cactaceae, possesses such wealth and variety of forms. Here are species of Stapelia, Mesembrianthemum, Anacampseros, Hoodia, Euphorbia, Aloe, Haworthia, Kleinia, Crassula, Cotyledon, Sarcocaulon, Trichocaulon, to mention only a few of the main genera of succulents—any one of which makes the European botanist's mouth water,—and not to mention the copious development of bulbous and shrubby plants.

(c) The deplorable fact that many of these astonishing products of evolution are disappearing. Some are perhaps already extinct. Overstocking and kraaling, veld fires, sluiting and denudation, ostrich farming and other causes are rapidly causing degeneration of the veld, which has changed to a marked degree within human memory.

(d) The need for the closer scientific study of Karroo plants.

(e) The rapidly increasing interest which is being taken in these bizarre forms of life, in particular from the point of view of gardening under arid conditions. As an example may be mentioned the flourishing Rock-Gardens of South African succulents on railway stations all over the Karroo, established under the enthusiastic guidance of Mr. Frith, Railway Horticulturist, and now providing an occupation and interest for railwaymen in their spare time.

In conversation between Sir William Hoy, General Manager of Railways, and Dr. Bennie Hewat, then Chairman of the Cape Peninsula Publicity Association, the possibility of establishing a Karroo Garden under Karroo conditions was mooted. It was agreed that such a project came within the proper province of the National Botanic Gardens, and this was recognised by the Trustees, who in August, 1920, agreed to adopt the scheme, provided that the slender financial resources at present available for Kirstenbosch should not be reduced thereby.

Meanwhile, in company with Mr. N. S. Pillans of the Bolus Herbarium, I visited a considerable number of places on the Karroo, as far as Beaufort West, in search for a suitable site for a garden. As a result of this, we came to the conclusion that the district immediately adjoining Whitehills Station, near Matjesfontein, was by far the most suitable for the purpose. Through Sir William Hoy, Mr. Frith was early associated with the scheme, and through his agency the late Mr. James D. Logan of Matjesfontein generously offered to present a piece of his Rietfontein Estate for the establishment of the Garden. This offer was confirmed by Mr. Logan's son, Mr. J. D. Logan, jun., the heir to the estate, with the utmost goodwill and enthusiasm for the scheme, which was also shared by the other members of the family, and it was agreed to regard the Garden as a memorial to the donor of the ground, who in this as in so many other respects showed himself a true lover of the Karroo and of South Africa. The exact site was

chosen by Mr. Frith and myself in conjunction with Mr. Logan, and has recently been officially surveyed. It is a roughly rectangular strip of land with a frontage of about half a mile on the south side of the railway main line, immediately to the east of Whitehills Station. It will thus be visible to railway passengers. The breadth of the area is about one-eighth of a mile, and the Garden will therefore comprise about 20 morgen.

The ground slopes gently upwards from the railway, and thus has a north aspect, admitted to be the best for succulents. The surface is well diversified and possesses a rich soil with areas of beautifully weathered rocks and patches of white quartz debris. There is sufficient variety of surface and aspect to give opportunities for establishing a very wide range of xerophilous plants. The best test of suitability is, however, the vegetation native to the locality: and here I may say that the Whitehills site is a perfect natural rock-garden as it is. There is a wealth of succulent and other vegetation upon the site unsurpassed by any other area along the railway line. The adjoining districts, moreover, will furnish numerous forms which are certain to succeed in the Garden, even though they happen to be unrepresented there at present.

The first essential in establishing the Garden is the erection of a strong goat-proof fence. Thanks to the efforts of Mrs. H. Burton, the money required for this has been subscribed privately. As soon as the fencing is completed, the work of stocking the Garden with plants from other localities will begin, and in this we hope to have the assistance of railway officials on other Karroo stations. It is not intended to make any serious alterations in the grading of the ground, and paths will only roughly be defined with a view to providing access to the different parts of the Garden. Only the minimum of interference with the present vegetation will be made, for in the "open" association of plants which prevails here as all over the Karroo, there is ample room for planting without a preliminary clearance. It is proposed to label examples of the native plants near the main entrance and also the plants introduced from outside wherever planted. A system of reference numbers will be used, and so it will be possible to keep records, to make comparisons with the same plant grown at Kirstenbosch, and so on.

The purposes which the Garden will serve are manifold. It will be a Nature Reserve, and it is anticipated that the result of merely fencing the ground will be to restore the vegetation to a condition which will surprise farmers and others who only know the Karroo in its present overstocked condition. It will be a repository of some of the most remarkable forms of life that the world contains, and these will grow in more natural conditions than can be possible at Kirstenbosch: consequently there will be opportunities for their observation and scientific study which have never before been attained. It will interest the gardener, and will help to make a particular branch of native gardening increasingly popular. And it will act as a centre for the supply of plants to the succulent garden at Kirstenbosch (now being initiated), to the railway rock-gardens, under the control of the Railway Horticulturist, and to Members of the Botanical Society.

In conclusion it must be said that we owe everything to the enthusiastic co-operation of Sir William Hoy and the Railway Horticultural Department under Mr. Frith, the generosity of the late Mr. Logan and his heirs, and the energy of Mrs. Burton, Dr. Bennie Hewat, Mr. Frank Cartwright and Mr. N. S. Pillans in fostering the project and helping to make it practicable.

R. H. Compton.

Kirstenbosch, May, 1921.

EXPLANATION OF PLATE: SOUTH AFRICAN PROTEACEÆ.

I. Leaf.—Figures 1, 2, 3, 4, Protea; 6, Leucospermum; 5, 7, Nivenia; 8, Serruria.

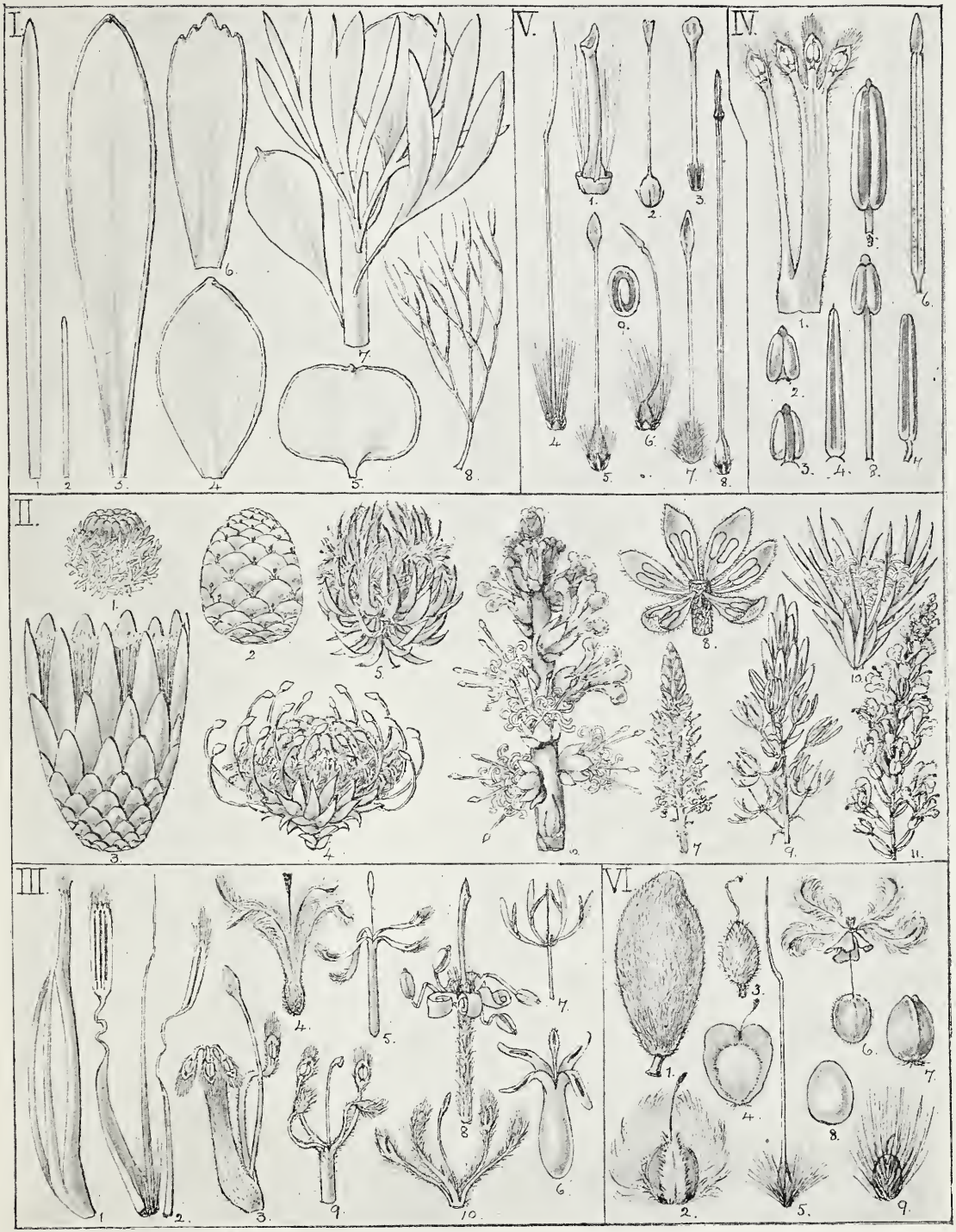
II. Inflorescence.—Figure 1, Leucadendron, male; 2, do., female; 3, Protea; 4, Leucospermum; 5, Serruria; 6, Nivenia; 7, Brabeium; 8, a whorl of do. showing 2 flowers in axil of bract; 9, Aulax, male; 10, do. female; 11, Spatalla.

III. Flower.—Figure 1, Protea, in bud; 2, do., open; 3, Leucospermum; 4, Leucadendron, female; 5, do., male; 6, Aulax, female; 7, do., male; 8, Brabeium; 9, Spatalla; 10, Serruria.

IV. Androecium.—Figure 1, Leucospermum, with stamens in position; 2, stamen of Spatalla, front view; 3, do., back view; 4, Leucadendron; 5, Faurea; 6, Protea; 7, Aulax; 8, Brabeium.

V. Gynaeceum.—Figure 1, Brabeium with annular disk; 2, Leucadendron; 3, Spatalla; 4, Protea; 5, Nivenia; 6, Faurea; 7, Aulax; 8, Mimetes. 9, Longitudinal section of ovary to show solitary ovule.

VI. Fruit.—Figure 1, Brabeium; 2, Aulax; 3, Spatalla; 4, Leucadendron, winged; 5, Protea; 6, Leucadendron argenteum; 7, Nivenia; 8, Leucospermum; 9, Faurea.



M. M. Page, del., 1921.

South African Proteaceæ.

SOUTH AFRICAN PROTEACEAE.

THIS Family forms one of the most conspicuous features of the flora of the South-Western Districts; and, although like Proteus of old, its members assume many guises, one soon learns to recognise a large proportion at sight. For they have a hardy and undaunted air about them, flowers and all, as of those accustomed to brave the continuous rains of winter and spring and the long dry summer months which make up most of the year, as they know it in their habitats of sandy flats and stony mountain-slopes.

DISTRIBUTION.—Geological records prove that members of this Family flourished in the north when the climate was more genial, but the numerous, about one thousand, survivors of those ancient forms are now to be found massed in the south—chiefly in Australia which has about 600 species, comprised in 29 genera, and in South Africa, with 14 genera and about 320 species, while the remaining seven genera are to be found in South America, New Caledonia, Tropical Africa, Eastern Asia, and in Madagascar and New Zealand. No genus is common to Africa and Australia, but our *Brabeium* is more nearly related to the Australian forms than to the African ones.

DESCRIPTION.—All are evergreen perennials—usually erect shrubs from four to 10 feet in height, more rarely small trees, like the silver-tree *(Leucadendron argenteum)* and the taller terblanz *(Faurea Macnaughtonii),* or low-growing and occasionally even decumbent shrubs, like *Serruria* and *Diastella.*

The leaves present a great variety of form, being sometimes either narrow-linear and rather needle-like (see plate I, 1 and 2) or cut up into needle-like segments (8), while in others the proportionate width becomes greater (3, 4 and 6) until as in *Nivenia* (5) the width is sometimes greater than the length. In Nivenia, too, the phenomenon of heterophylly occurs, the lower leaves being divided into separate portions and the upper ones becoming entire, or occasionally the entire and divided ones occur indiscriminately (7). In most cases the margin of the leaf is thickened and often quite entire (1, 2, 3, 4 and 5), but in the genus *Leucospermum,* and sometimes in *Mimetes,* the apex only of the leaf is toothed (6), while in *Brabeium* (wilde amandel) the whole margin is distantly serrate. It is in *Brabeium* also that one finds the leaves arranged in whorls, the general rule being the spiral arrangement, with one leaf at each node. Throughout the Family stipules are absent, and, although short petioles frequently occur, it is rare indeed to find another anything like as long as that of the king-protea *(P. cynaroides).* Besides being leathery in texture the leaves often have a hairy covering, and these two qualities together with the sunken stomata prevent an undue loss of moisture by transpiration. This is a most important consideration for an evergreen plant—a consideration which does not affect the deciduous perennials, nor the bulbous plants which die down, and have an underground resting-stock, well protected from the summer drought. It is, therefore, a matter of great interest to examine the leaves of xerophytic plants like the Proteaceae and others which form one of the chief constituents of the "macchia" or hard-leaved-shrub-formation of the South-Western Region, and to note the various methods adopted to minimise transpiration. Frequently there is a reduction of the leaf-surface as in *Serruria, Protea* and *Spatalla;* and an overlapping which ensures a certain amount of shading for each leaf; while yet another device may be found in the "set" of the leaves. Sometimes they point upwards so that the tips instead of the whole flat surface are presented to the direct rays of the sun; and sometimes they have a half-twist, so that the direct rays strike one margin of the leaf only.

The flowers in all the genera except *Leucadendron* and *Aulax* are hermaphrodite and consist of four perianth-segments, valvate in the bud, and variously united—*e.g.,* in Serruria (III, 10) they are joined at the very base only. In others again the union is much greater (5, 6, 8 and 9), and in *Protea* and *Leucospermum* the perianth divides into two parts, becoming bilabiate—the upper lip consisting of three and the lower of one segment (3). In *Protea* this lower segment completely separates itself from the upper lip (1).

Attached to the perianth-segments, and sheltered beneath their slightly widened apex, are the four stamens, with usually short or very short filaments. Each anther consists of two lobes, and the connective is often produced beyond the lobes (2, 4, 5, 6 and 8). Their dehiscence is by longitudinal slits.

The nectary is composed of four separate scales, arising from below the ovary (V), except in *Brabeium* where they are united to form a cup-like structure (V, 1).

In the gynaeceum, which is superior, the carpels are reduced to one, the ovary bearing a solitary ovule, except in *Brabeium,* where it is 2-ovuled. The style is usually stout and rigid, and the stigma assumes many different shapes (V).

The flowers of *Leucadendron* (III, 4 and 5), and *Aulax* (6 and 7) are of two kinds, borne on separate plants,—the staminate or male flowers having a barren carpel or pistillode, and the pistillate or female flower having four barren stamens or staminodes.

Such then are the individual flowers which we find—never singly but clustered together in various ways, the youngest flower always in the centre, and one flower in the axil of a bract except in *Brabeium,* where there are two (II, 8). These clusters are what we call either a Protea or a "kind of a Protea." The former is easy to recognise, for the flowers are in a cup or involucre (II, 3) made of overlapping and usually very showy scales, which are either glabrous

or silky, and sometimes bearded round the apex. Moreover there are numerous flowers in each cup or head, and the heads themselves are solitary, and terminate a branch, while the fewer-flowered heads of *Nivenia, Mimetes, Spatalla,* etc., are in the axils of the upper leaves. In the case of *Nivenia, Spatalla,* etc., these upper leaves are reduced to small scales (II, 6). The involucre of *Leucospermum* is much smaller and less conspicuous, and the perianth far more evident than in *Protea,* as are also the showy styles which stand out, or curve in beautifully towards the centre of the inflorescence (II, 4). *Leucadendron* has no, or scarcely any, involucre as a rule, but the uppermost foliage-leaves, surrounding the inflorescence, become brighter coloured—sometimes a deeply glowing red—and are often larger as well, when they are exceedingly attractive. The bracts, too, are well developed in this genus (II, 2), as also in *Serruria* (II, 5).

The fruit is an achene, and is usually adapted for wind-distribution, being provided with tufts of silky hairs (VI, 2, 5 and 9), or wings (4), or persistent perianth-plumes (6). Its corky covering enables the wild almond to float, and be dispersed by water, and the outer coat of hairs would also prevent it from getting soaked. In *Leucospermum* the fruits ripen soon after flowering, thus differing from *Protea* and *Leucadendron* where the interval is nearly a year, and the whole inflorescence dries and falls. Being light and easily blown about by the wind it is possible the smooth, round achenes are distributed in this way.

Pollination is effected by birds and insects, and the pollen-mechanism is similar to that of *Compositae* in several respects. The stamens are ripe first, and the style projects and presents the pollen, making it accessible to the visiting agent. But it releases itself from the tension of the closed perianth with something of a jerk, and, as it were, declares the flower open; whereas in *Compositae* the corolla opens, and the style, piston-like, pushes its way slowly out from the anther-tube. Nor does there seem to be any special arrangement for self-pollination should a cross fail, as there is in *Compositae.* It is interesting in this connection to note the variety of furrows and hollows for retaining the pollen on the upper portion of the style, of which probably only the very tip is stigmatic.

Uses.—Van Riebeeck and the early Dutch colonists used *Brabeium* as a hedge plant, and the wood of *Protea grandiflora* for axles, but in later times these and all the more woody species were cut down only for fuel. In 1862 Dr. Pappe (Silva Capensis, 32) wrote of *P. grandiflora*—" Bark brown, thick, much rent. The wood has a reddish tint; its grain is beautifully reticulated, and renders it useful for ornamental furniture, picture-frames, etc. It is sometimes employed for fellies, ploughs, etc. The bruised leaves, mixed with a saturated solution of iron in water, produce a tolerably good black writing ink. The bark which furnishes a superior article for tanning is used as an astringent in diarrhoea, and good charcoal is often made of the wood." During the eighteenth and early nineteenth centuries Proteaceae were cultivated in Europe, but one never heard of them in South African gardens. Now that they have been grown so successfully at Kirstenbosch from seed there is no reason why they should not have a high place among the ornamental shrubs of the world. Besides their horticultural value several species provide beautiful wood suitable for delicate work in joinery, and the bark of others is employed for tanning. The roasted fruits of *Brabeium* are used as coffee, though they should not be eaten uncooked. Dr. Pappe writes—" A fatal case of poisoning caused by the eating of the Wild Almond in its raw state has just (May, 1862) occurred at Genadendal." The nectar of certain species of *Protea* serves as a cough-remedy as well as a sweetmeat under the name of " bosjesstroop."

Several members of the Family are to be found wild at Kirstenbosch in sufficient numbers to form a considerable part of the vegetation. First and foremost are the silver-trees, chiefly on the lower slopes of the mountain. Although these occur in three or four spots in the Stellenbosch and Paarl Districts, their headquarters seem to be the Cape Peninsula, where, alas! they have been forced to give way before the advance of civilisation, and are being crushed out of existence by the omnivorous pine. There are, however, some small clumps left on Lion's Head and the lower slopes of Devil's Peak, while there are still some fine groups at Kirstenbosch, where they will be protected and their offspring cherished for all time—our most precious possession. On the higher slopes and extending to the top of the mountain is another species of the same genus, *Leucadendron salignum,* with greenish-yellow foliage, making lovely patches of pale gold on the more sombre green background, especially in the spring. *Leucadendron adscendens* and *Leucadendron minus* occur more sparingly.

On the higher slopes, too, is the grey-leaved waa-boom *(P. grandiflora)* playing hide and seek with us on sunny days, as we look for them from below. For the leaves are " edge-on " to the sun, and, as it strikes them, there is very little reflection of light and scarcely any shadow; and it is only as the sun disappears over the mountain that they gradually come into being again. Then there is another Protea which, though a tall fine plant when growing at its best, has yet been regarded as the Cinderella in the genus, and has been called the plain one *(P. incompta)* because of its rather colourless involucre. But wait till the fairy-godmother comes in June, and the scales open apart to show the pink foam of soft hairs in the cup. Then the long-tailed sugar-birds come for their sips of nectar and beak-fulls of the rosy wool for a warm lining to their nests, and then you will see gay revelry for a season, as you look down from the Contour-path between the Nursery and Skeleton Gorges! From here too you will see the line of dark green *Brabeium* which marks the course of the Skeleton Gorge Stream; for the natural habitat of this species is along the banks of running streams, often in dense formation and with its branches lacing overhead, so that the stream flows

under a green archway. Kreupelhout *(Leucospermum conocarpum)* appears much more sparingly on the slopes, but there are several fine specimens looking very beautiful when their yellow heads are fully out in flower. The only other genus wild at Kirstenbosch is *Serruria,* represented by *S. Burmannii* which grows very plentifully.

The following is an attempt at a key for determining the genera of the South African Proteaceae in the field.

Leaves arranged in whorls **Brabeium.**
Leaves arranged in spirals.
 Flowers unisexual, dioecious.
 Male inflorescence a raceme **Aulax.**
 Male inflorescence a head or short spike **Leucadendron.**
 Flowers hermaphrodite.
 Leaves entire or toothed at the apex.
 Inflorescence an elongated spike... ... **Faurea.**
 Inflorescence not an elongated spike.
 Heads terminal.
 Perianth zygomorphic.
 Lower perianth-segment separating entirely **Protea.**
 Lower perianth-segment united at base ... **Leucospermum.**
 Perianth actinomorphic.
 Perianth ½ inch or less long, **Diastella.**
 Perianth 1 inch or more long **Orothamnus.**
 Heads lateral.
 Heads in the axil of scale-leaves.
 Perianth zygomorphic **Spatalla.**
 Perianth actinomorphic.
 Heads arranged in a cylindrical form **Spatallopsis.**
 Heads arranged in a globose form **Sorocephalus.**
 Heads in the axil of foliage-leaves **Mimetes.**
 All the leaves, or at least a few, much divided.
 Heads more than 4-flowered **Serruria.**
 Heads 4-flowered **Nivenia.**

SUMMARY.—Trees or shrubs, erect or decumbent, glabrous or pubescent; leaves arranged in spirals, very rarely in whorls, exstipulate, sessile or petiolate, entire, serrate, dentate, or partite; inflorescence indefinite—capitate, spicate, or very rarely racemose; flowers tetramerous, actinomorphic or zygomorphic, unisexual or hermaphrodite, protandrous; perianth petaloid, valvate in bud; stamens four, epiphyllous; carpel one, superior, ovary 1-ovuled, or very rarely 2-ovuled; fruit indehiscent, achene.

L. BOLUS.

Bolus Herbarium,
University of Cape Town,
May, 1921.

THE CULTIVATION OF PROTEAS AND THEIR ALLIES.

THE majority of the plants of the order Proteaceae being kopje, hillside, or mountain side plants it is natural to conclude that a free open position on a well-drained slope is the most suitable site for them, taken collectively. A few such as *Protea cynaroides,* and *P. lacticolor* favour the scrubby north slopes of kloofs, etc., with a southern or eastern aspect. Others again descend into the sand flats of mountain and lowlands. And yet a few, as *Orothamnus Zeyheri, Mimetes palustris,* etc., are confined to swamps or marshy places, and are often of limited distribution.

The site selected for the "Protea Garden" at Kirstenbosch is part of the original Silver Tree Forest, in which, however, the Silver Trees had been largely displaced by the Cluster Pine. On this area, in addition to the Silver Tree, *Leucospermum conocarpum* and *Serruria Burmanni* are other native Proteaceae. Close at hand is found *Protea incompta* and higher up a Leucadendron sp. and *Protea grandiflora.* The soil has proved satisfactory in practically all cases, being a sandy loam overlying clay and ironstone gravel in irregular formation. Here can be seen in flower at the present time species of the Peninsula, Caledon, Knysna, Oudtshoorn, Prince Albert, Ceres and Wellington districts of the Cape, and near by thriving plants of the outlyers from the Transvaal and Natal. The Eastern representatives, favoured by the recent and prolonged dry warm weather, are in much better condition this season; and from now onwards there is promise of abundant bloom for practically the year round.

The classical lines of a spray of leaves and flower-head make the Protea pre-eminently suitable for use in Art, emblematical or architectural. In Gardens, the distinctive variety in form of flower, outline of plant, as well as variety in colour, make them singularly attractive and conspicuous objects in the positions for which their natural and varied habits make them suitable, be it on rockery or lawn or in the Wild Garden. In colour forms there are several albinos; and rather attractive green varieties of *Protea rosacea,* and *P. pitiphylla,* the latter coming true from seed, but the former so far reverting to the type

colour, a distinct glassy or metallic crimson. The lovely shades of red, or pink, or yellow in the colour varieties of that gem of the order, *Protea barbigera*, make it one of the most glorious flowering plants of the whole vegetable kingdom. Something comparable with the much-prized orchids of Brazil, it surpasses them alike in exquisitely harmonious colouring and beautifully proportioned form.

In horticulture they fall into a class termed "Hard-wooded," which carries with it the implication that they can be propagated from cuttings of ripened young wood, or by grafts. With rare or difficult species either of these methods may be brought into use, but under actual conditions and circumstances here prevailing, they being indigenous plants, the easiest and most readily available method is by seeds. In so far as the collection of Proteaceae is here established it is noticeable that the genera Protea and Leucadendron predominate, with only odd species of Aulax, Mimetes, Leucospermum, Serruria, etc. This has no doubt been brought about by reason of the persistence of the seedheads in Protea and the cones in Leucadendron. In both, the seed takes twelve months from flowering to develop and ripen. In Leucadendron the seed may be dispersed the summer following. In Protea the seed is seldom if ever dispersed, except by fire, under three or four years, so that seeds are always obtainable from plants that have passed their first flowering season. In the other genera mentioned the seed develops, ripens, and falls individually before the flower head, and in some cases almost before the flower heads have lost their colour. The tempting grain-like seed invites the attention of birds, and no doubt explains why seed is seldom found on the ground.

The sowing of Western and South-Western species should be done in March and April, and again in September with the Eastern, Central, and Northern species. For raising plants in tins a light sandy compost, made up of two parts each of loam and leafmould, and one of sand, is necessary, well mixed and passed through a sieve with a quarter-inch mesh. Tins cut lengthways, with drainage holes made with a pick or sharp-pointed crowbar so that the holes do not corrode or choke up, are essential; and to ensure free passage of water, the holes must be punched from the inside. A layer of dry leaves over the holes, followed by a layer of the rough siftings from the compost pressed down evenly, and then the compost pressed down firmly with spreading fingers to a surface one inch below the rim. Stand the tin level, and level the surface of the soil. Select the largest and plumpest seeds that do not break easily, hold by the tuft of hairs in the case of Proteas, and insert in a hole made by a piece of hoop iron or flat stick so that the tips of the hairs are level with the surface. Space the seeds two inches apart each way, and the orthodox pricking-off will not be necessary as when broadcasted. Germination is seldom good, and varies in length of time in different species and at different seasons. When four or five months old transfer singly to quarter-tins using a compost somewhat coarser and with one part less of leafmould. Alternatively, they can stand till good rains have fallen, when they can be planted to their permanent positions. For some days before planting out they must not be allowed to approach dryness, and a day for the work of planting should be chosen immediately prior to rain. The holes can be opened in fine weather, two spades square and two spades deep. Turn down a spade's depth of the surface soil around the hole into the hole until filled to the level for planting, tread firm once only in the same place. Cut round the plants in tins with a trowel, and lift carefully with a ball of soil, transfer intact, filling in with surface soil around the plant, and treading firm as before. Should soaking rains not follow, water by hand. If planted so at the right season no further watering is required, only surface cultivation to conserve moisture and keep down weeds. Planting out seedlings the first winter obviates staking against wind, as the roots get a better hold and growth is short and sturdy.

Sowing *in situ* has been found entirely satisfactory when seeds are available in the proper season, and is to be recommended where the species is known. When unknown, and it is desirable to mass them the seedlings are an aid to that end. When preparing for *in situ* sowings weeds must be skimmed off the surface, the clean surface soil put on one side, and the subsoil or the second spit on the other side. Dig in the surface soil around the hole as before, fill up centre of hole with reserved clean soil, and place the subsoil round the outer surface of the hole. Three or four seeds can then be sown about six inches apart in good and clean soil.

Modifications of soil and condition will be required as individual requirements are learned. In the case of the marsh or swamp species, including *Brabeium stellatifolium*, usually a stream side tree, a sandy peat or sandy humus should be given, and the pots or tins stood in an earthernware saucer to be kept filled with water, or at the side of a stream if available. A permanent site must be selected where the water-table or level is twelve to eighteen inches below the surface. The denizens of sandy flats may be accommodated with the general collection, as they, in common with many South African plants, possess a wonderful adaptability to conditions and soils. An exception to the rule for full sun for all is found in *Protea cynaroides*, which is found at its best under partial shade.

The above particularly applies to Protea: when handling seeds of other genera they should be sown in drills drawn across the tins to a depth equal to the widest part of the seed in hand and re-covered to level.

J. W. Mathews.

Kirstenbosch, June, 1921.

THE ROEDEAN RESERVE FOR NATIVE SOUTH AFRICAN PLANTS.

By GWENDOLEN EDWARDS, B.Sc.

INTEREST in Kirstenbosch is becoming more widespread as the years go on, and the institution of the National Botanic Gardens is beginning to fulfil the hopes of its founders by encouraging an interest in the cultivation and preservation of our wonderful native flora.

When visiting Kirstenbosch early in 1917 Miss Lawrence and Miss Earle, of the Roedean School, Parktown, Johannesburg, were inspired to reserve a portion of the school grounds as a sanctuary for native plants. To this end they devoted about three acres and appointed a science mistress who was also to superintend the native-garden.

A ridge of sandstone forms an outcrop throughout the length of the Roedean grounds. It runs more or less west to east being higher at the western and eastern extremities; while about midway there is a break to admit of a road. The gap faces north and gives a glimpse of kopjes and infinite blue distances beyond. The Magaliesbergen themselves are just hidden by a near-by kopje, but the outlook is nevertheless very pleasing.

The mere fact of preserving the native growth on the ridge is a good work, since it is characteristic of the local flora. At the eastern end of the ridge there is a kopje crowned with a group of *Protea abyssinica,* the common hardy Protea of these parts. It is somewhat like "wa'boom" in its general appearance. The southern slope below this is a mass of flowers in the Spring. Most of these are of but short duration but they are gay while they last. There are numbers of pink and white Dianthus, everlastings of various kinds, *Senecio orbiculata,* pink Nemesias, a deep purple Polygala and two species of Hypoxis, which are plentiful. In November purple Vernonia, a bright golden Berkheya and *Aloe Cooperi* (a bright scarlet dwarf species) make the kopje gay with their contrasting colours. There is a local wild sweet pea (Lathyrus sp.) which flowers profusely, and the handsome mauve *Dimorphotheca spectabilis* is also found. *Euphorbia truncata* forms queer, green, cushion-like groups, and *Selaginella rupestris* creeps with mossy habit in the crevices. In clefts among the rocks a hardy species of Pellaea grows and *Cheilanthes hirsuta* is fairly common.

In June the kopje is covered with the coral-pink flowers of *Aloe Davyana,* while in January and February *Pentanisia variabilis, Walafrida densiflora,* two or three species of Gladiolus, an orange species of Tritonia, and other plants display their charms. There are many species of Asclepiads apt to be overlooked by the casual eye but perfect in detail and delicate colouring when noticed as they deserve to be. At this time a species of yellow Athanasia begins to show against the rocky background, and *Leonotis microphylla,* together with *Senecio crenatus,* appears on the skyline.

The grasses, of which there is a great variety locally, become more and more conspicuous from November onwards to March. One of the first kinds to appear is a charming red-tinted grass. *Aristida junciformis* forms graceful feathery tufts among the lichen-covered rocks.

There are numerous shrubs occurring in the Highveld which are worthy of note. At Roedean there is one particularly interesting group about a hundred yards from the Proteas. The bulk of this is composed of a specimen of *Kiggelaria africana* ("spek-hout"). This is unfortunately—from the spectacular point of view—a male specimen; but we have several smaller females which show a wealth of scarlet seeds. It is interesting to note that Kiggelaria is dwarfed to shrub-like proportions at this altitude, the specimen in question being about twelve feet high. Growing with it one finds a deciduous Rhus, a Gymnosporia, Vangueria, etc. Over the whole of one side of this group *Clematis brachiata* flings its sweet-smelling clusters of waxy white and yellow flowers.

Clematis Stanleyi is another very ornamental shrub of which numbers occur along the ridge. It grows like an Anemone—the colouring, too, being like *Anemone capensis*—but the perianth consists of only four sepals. *Royena pallens* is plentiful and makes a brave show with its lavish profusion of red berries. One bush grows in partnership with a red and yellow Lantana.

Chrysophyllum magalies - montanum ("Stamvruchte") is a handsome shrub and near it are usually to be found trails of Landolphia with its Jasmine-like flowers. There are two species of rather sub-shrubby Indigoferas and a bush of Nuxia sp.

Cotyledon orbiculata (?) begins to flower in the sheltered parts in April and again in August, while *Senecio argenteum* makes a fine show in April with its silvery foliage and bright golden flowers.

It is interesting to note that since our care of the wild garden began, the increase in numbers of plants has become noticeable. Also, when comparing our veld—which is not burned—with that just beyond the

boundary—which is burned annually—the difference in our favour is remarkable in regard to the numbers and variety of annuals and the free growth of the shrubs. So much for the native plants.

One of the points to which we direct our attention—as far as funds and time will allow—is the attempt to acclimatise plants from other parts to weather conditions on the Highveld. In this we have had a certain amount of success. Along the northern boundary we have planted trees and shrubs which were supplied, together with much kind advice, by Dr. T. R. Sim. *Virgilia capensis* has done particularly well. Up here it flowers from February to July. *Podocarpus falcata* (yellow-wood), *Zizyphus mucronata,* and *Halleria elliptica* all seem quite happy; while *Gardenia Thunbergii* has not yet flowered and *Calodendron capense* has to be protected from frost.

About a dozen shrubs of *Podalyria calyptrata,* out of about eighteen contributed by Kirstenbosch, are growing well—one being a fine specimen which flowered profusely last September. A number of plants grown from Kirstenbosch seeds have established themselves. Some of these are: *Barosma crenulata* (Buchu), *Felicia aethiopica,* Hibiscus sp., Dianthus sp., Watsonia sp., Dierama sp., *Thunbergia alata,* etc.

Psoralea pinnata from the Northern Transvaal is well established and seeds freely. Succulents from all parts seem to do well. A very welcome and valuable addition to our small collection of the latter has recently been contributed by Mr. Frith, the Railway Horticulturist, while amongst other kind donors have been Mr. Walter Webber and Dr. Pole-Evans.

Bauhinia (" Pride of de Kaap ") grows here as well as miscellaneous plants from such places as Zululand, Swaziland, Natal, the North-Eastern Transvaal, the Falls, Eastern and Western Cape Province, etc.

Cape " bulbs " are not altogether happy in this part of the world—the rainy season, for one thing, is topsy-turvy. Nevertheless *Gladiolus gracilis,* Babiana sp., Ferraria sp., Antholyza, Freesia, etc., have flowered here. Such plants as Agapanthus, Nerine, Haemanthus, however, do quite well when left alone by the moles. Various species of Ornithogalum are also grown successfully, while Arums—white, pink and yellow—do well.

Although funds are not too plentiful, a certain amount of development is possible—especially when kind friends are always contributing, and when one collects for oneself during the holidays. There is a Natural Science Club, membership being open to the upper and middle school. The members do valuable work by collecting local material when out upon excursions.

Certain modifications have to be made from time to time in our schemes owing to the almost incessant building operations. In spite of many difficulties, however, certain definite successes are to our credit. Stone was quarried (not without protest!) from the southern slope of the kopje below the Proteas. This left an ugly gash which seemed hopeless at first sight. The severe frosts notwithstanding, this, with a little judicious covering in the winter, has been converted into quite a charming little fern grotto which boasts a real tree fern *(Cyathea Dregei),* an Adiantum, two species of Dryopteris, a Marsilia, *Asparagus plumosus,* etc. Several species of the Smilax-like Asparagi are planted so as to grow downwards and curtain the steep bank of the cutting. A few shrubs, one of which is *Rhamnus prinoides,* have been planted in this part, while the drier slopes are gradually being planted with dwarf Crassulas, Mesembrianthema, etc. *Schizostylis coccineus* has been successfully established in one hollow, and makes a fine show with its deep crimson flowers.

The occurrence of a sufficiency of white quartz has made it possible to replace some ugly wire fences with beautiful, glistening walls. These are filled in with earth and planted with creeping Crassulas, Microloma, etc. A kind of rough terracing has been found useful in other parts.

The ground round the new swimming-bath has been levelled and planted with Kikuyu grass. This is a successful grass for the Highveld as it remains green in the winter—no mean advantage when all around is brown, dusty and bare.

The creation of the " wild garden " has been a distinct asset to the school. There is an unlimited mass of material to work with as far as botanical instruction is concerned, and seeing the plants actually growing makes a great impression on the young mind. The girls are able, too, to form a better conception of the floral wealth of their native country, and they often become fired with zeal to have a native garden of their very own. From the point of view of the teacher, the interest of gardening and the total change of occupation is an excellent antidote to teaching. To be truly successful in the profession one must be perennially " fresh "—a jaded mind produces boredom in the young! To have a garden growing day by day is to have an absorbing and abiding interest which takes one out of oneself, and makes one forget the petty vexations of the daily round.

It is an ideal devoutly to be worked for, namely, that a patriotic pride in the unique flora of our country may stir the hearts of every individual domiciled in South Africa. This, fortunately, is an interest which is beyond the sphere of politics, and is a subject by means of which may be drawn together those holding opposite views in other phases of life. For this reason let us wish continued success to Kirstenbosch and similar public and private efforts—for who can tell how far-reaching their influence may be?

Roedean, Johannesburg, May, 1921.

MAMMALS AT KIRSTENBOSCH.

THE mammalian* fauna at Kirstenbosch is certainly not so poor as might appear to be the case if one judged entirely by the number of mammals seen in a day spent at Kirstenbosch. Perhaps the chief reason for this apparent scarcity is the fact that many of them are nocturnal in their habits, and that others are either very cautious or extremely timid—all having in common a mortal dread of man. For while life expresses itself there, all heedless of man, in forms innumerable—spiders with their webs festooning almost every bush you pass and cranny you peep into; thousands of little spittle-bugs each in its foamy bath; and other insects on work or pleasure bent, filling the air with vital sounds; frogs croaking below and birds calling above; grasshoppers jumping aside to make way for you; and the wicked old brown locust quietly moving to the other side of the branch if he feels his presence in any way obtrusive—yet, except that occasionally a dassie may be seen hurrying indoors at your approach, there is but a form in the low growth on the hill-side to show where a buck lay last night, and a spoor on the path to mark his retreat; or a black and white quill to indicate that a porcupine has passed that way; or the best fowl gone from the hen-roost, with foot-prints to prove that a hungry carnivore has paid the fatal visit which must lead eventually to his doom and that of his kind—a doom which no human eloquence would serve to moderate.

The "tiger" *(Felis pardus)* who paid Mr. Cloete a visit on his first night at Kirstenbosch could scarcely be encouraged to come again. Nor can we mourn over the departed lions which were not uncommon, we are told, near Cape Town at the beginning of the eighteenth century. We must also realise that hippos are too bulky to disport themselves among us as they did, when van Riebeeck came, in the swamp which is now Church Square, or in the Vaarsch Vlei just outside Salt River Station (though we might have kept Zeekoe Vlei for them!), and that elephants† might prove an impossible burden. At the same time one cannot refrain from earnestly wishing that this sad chapter of extermination may soon be closed. Are we not apt to destroy thoughtlessly—nay ruthlessly—and often to our own disadvantage? It behoves us then to remember "how much there is to be said about animals—their domestic life, their courtship, their helpful partnership, and their parenthood," and to watch their ways "and seek after some sympathy with them, so that we may respect their love, and salute them not with stone or bullet but with gladdened eyes" in the spirit of the poet who wrote:—

"For Love, though blind himself, a curious eye
Hath lent me, to behold the heart of things,
And touched mine ear with power. Thus far or nigh,
Minute or mighty, fixed or free with wings,
Delight from many a nameless covert sly
Peeps sparkling, and in tones familiar sings!"

Five Orders of the Class Mammalia are represented at Kirstenbosch, viz.: Cheiroptera or winged hands (bats), Insectivora or insect-eaters (golden mole and shrews), Carnivora or flesh-eaters (cats, genet, mungoose, muishond), Rodentia or gnawers (rat, mice, vole, blesmol, hare, porcupine), Ungulata or hoofed ones (grijsbok) and the dassie with a general affinity to the Ungulata. The Order Primates ("pronounced as three syllables and having no reference to the clergy of the Anglican Church": *Ray Lankester)* must have been represented at Kirstenbosch until quite recently by the Baboon[1] which may still be found in the unfrequented parts of Table Mountain and Constantiaberg.

The notes following have been taken from Sclater's "Fauna of South Africa" and other reliable authorities, and I am indebted to the Director, Ranger, and other residents at Kirstenbosch, for some of the records I have quoted.

The bat[2] most often seen is probably the little one which comes out from its hiding-place at dusk and with rapid, noiseless flight pursues the numerous insects whose "day" also begins with the setting sun. For it belongs to the group known as the Small Bats (Microcheiroptera). It is about $3\frac{1}{2}$ inches long, including the tail (1.30 inches), and has many relations, some of which are no doubt to be found at Kirstenbosch, *e.g.*, the European[3] and the Cape[4] Horseshoe Bats, with their complicated nose-leaf. Bats are altogether remarkable among mammals, being the only truly flying ones and having the extraordinarily well-developed sense of touch—or rather more than a tactile sense, as it enables them to appreciate the presence of obstacles without actual contact. This appears to reside in the wing-membranes, large ears, and the "nose-leaf." From the weakness and reversed position of the hind limbs bats are unable to walk and chiefly by the aid of their clawed thumbs crawl along in a laborious manner. When at rest they usually suspend themselves by their hind toes, head downwards. As a rule only one young is produced at a birth, and it remains clinging by its claws to the fur of the mother, clasping one of the two mammae in its mouth, safe while the mother is in flight, and when at rest with her ample wing spread over it to keep it snug. Thus it is guarded until nearly full-grown—surely the most tenderly cherished of babes.

*Mammals may be described as back-boned animals with a covering of hair, whose blood is constantly preserved at a fixed temperature, as a rule somewhat higher than that of the surrounding air. Their brain is more highly developed than that of other animals. In all cases the tender young are fed with milk provided by the mother from the mammary gland.

†The last elephant was shot on the Cape Flats in 1702 but Captain Hop's Expedition found plenty of them near the Oliphants' River in 1761.

[1] *Papio porcarius.*
[2] *Vespertilio capensis.*
[3] *Rhinolophus ferrum-equinum.*
[4] *R. capensis.*

The common Fruit Bat[5] or "Collared Flying-fox" is about 5½ inches long with a stretch of about 25 inches. It begins to be evident when the loquats ripen, and destroys far more fruit than it devours, so that it does not deserve the respect and entire protection due to the useful insectivorous bats, which can be claimed to be of the greatest economic value to man.

The most notorious member of the Insectivora is the Cape Golden or Creeping Mole,[6] whose track one can follow by a slight upheaval of the soil running on in a continuous line. It is not easy to decide whether this little creature should be destroyed or not. It feeds on the insects that attack the roots of plants and on various larvae passing through a stage in the ground often preparatory to doing damage above ground. It destroys quantities of larvae of a certain moth which spend the day deep in the earth near the roots of the plants on which they feed during the night. On the other hand its tunnelling disturbs the roots of plants, so that it would be necessary always to follow its track and tramp the soil back carefully into its place. It is about 4½ inches long, with very soft fur, which is dark velvety brown in colour, but showing a coppery iridescence when held in certain lights. The eye is small, lying completely underneath the skin and covered with thick fur, and there is no external ear—the small circular opening being surrounded by hair and, like the eye, difficult to find. The limbs are very short and are enclosed in the general skin almost to the ankles, the fore-limbs with four clawed digits, of which the third bears the enormously enlarged strong claw, and the hind foot with five claw-bearing digits of almost equal length. The tail is practically absent, being entirely under the skin and not projecting at all. With its muscular muzzle adapted for boring in the earth, and its strong limbs and claws, it is beautifully fitted for its particular mode of existence. It makes a round nest of grass in which the young are born. Very little is recorded with regard to its ways. Does it also, like the European mole, grimly form a living larder of decapitated earth-worms unable in the winter to regrow their lost heads, and so, deprived of the power of co-ordinated movement, unable to crawl away?

The other members of this Order (Insectivora) are the Large Shrew[7] and Smuts' Shrew,[8] both about the same size—head and body a little over 3 inches. They are rather mouse-like in appearance but have much smaller ears and shorter hairy tails, as well as the pointed snout typical of the Order, projecting considerably beyond the lower jaw in their case. On either side of the body is a gland opening near the root of the fore-limb which secretes a fluid. This often gives a strong musky smell and no doubt accounts for the fact that, although cats will often catch shrews and will kill them, they do not seem ever to eat them.

The general colour of the Large Shrew is light reddish brown and slaty above, silvery grey, slaty and dirty white below. The tail has a thick covering of short brown bristles and a number of scattered longer white hairs. Smuts' Shrew is without these longer hairs and has the fur almost black above with the tips of the longer hairs yellowish brown, giving a speckly appearance to the fur. Their teeth are white and not reddish as in the European shrews.

One wonders how such a useful little animal as the shrew came by its evil reputation. "The poison of the Scorpion and Shrowe and such like venomous beasts," writes Lyte in 1578, and the older proverb says "When all shrews have dind, change from foule weather to fine is oft enclind." Some scholars have derived the name from the same root as shred (O. E. skren=to cut). Shrewd once meant malicious and even now one would prefer not to be considered too shrewd. Human shrews were known in literature before Chaucer's time!

Nearly all the members of the Order Carnivora at Kirstenbosch are poultry-yard thieves, the two wild cats being specially bad ones. The Tijger-bosch-kat[9] is a light-bodied creature with a small head and large ears, tawny yellow above and on the flanks with black spots, which on the nape and upper part of the shoulder coalesce to form six more or less well-defined black lines; below white or nearly so. The legs are long, spotted like the back, tail very short, less than half the length of the head and body, the spots at the base large and gradually forming indistinct rings towards the tip. It measures just over 3 feet in length, head and body, the tail being about a foot long, and stands about 20 inches high at the shoulders. Mr. Fitzsimons gives a charming account of "Foxy," his pet Serval which, captured as a kitten, grew up as tame as any domestic cat. He describes an incident which illustrates one of this cat's methods of obtaining its prey. "It happened to observe a Bush Pigeon sitting on a branch, and crouching low it took advantage of the scrubby bushes for cover, and succeeded in crawling unseen almost beneath the spot where the bird was preening its plumage. Then, with a single bound, the Serval leaped straight up into the air, a distance of about ten feet, seized the bird with its claws, and fell in a heap on the ground with its prey." It is also an expert climber.

The Kafir Cat[10] or African Wild Cat is found all over Africa and extends into Asia. Many naturalists have maintained that the European domestic cat is chiefly derived from the north-eastern form of this species. It is at least certain that the animal was domesticated and held sacred by the ancient Egyptians, as carcases have been found in great numbers embalmed in the tombs of these people. It breeds freely with the domestic cat, and in many parts of the country it is difficult to keep the ordinary domestic tom cats, owing to the superior fighting powers of the wild cat, which comes down around the farms during the breeding season. It is a very plucky and ferocious animal, rather larger than a large domestic cat, the tail being rather less than half the length of the body. In colour the species is brownish grey with slight

[5] *Rousettus collaris.* [6] *Chrysochloris asiatica (=C. aurea).*
[7] *Crocidura flavescens.* [8] *Myosorex varius.*
[9] *Felis serval.* [10] *Felis ocreata caffra.*

transverse dark stripes on the body, underparts yellowish buff, limbs darker than the body and ringed with about five black bars varying in individuals. The head is dark with darker irregular markings and there is a black spot in front of each eye.

Closely allied to the Felidae is the Family Viverridae, carnivores with a somewhat elongate head and body and short limbs as compared with the Felidae. It includes the civet, genets, mungooses, and meercats.

The Small-spotted Genet, Musk-cat or Misselyatkat[11] is grey with a dorsal black stripe, sides of the body spotted with black, the spots being arranged in about five irregular longitudinal rows. The head and body measure 23 inches, and tail 17 inches. The claws are only partially retractile. The Genet fights fiercely with teeth and claws when brought to bay and excretes a fluid of nauseating odour from a pair of glands under, and at the root of, the tail. Some thirty species of Genet are found in Africa, one of them extending to Spain, South of France and South-Western Asia. In South Africa there are four kinds.

Both the Large Grey Mungoose or Grijse Muishond[12] and the Small Grey Mungoose or Neethaar[13] are speckly grey in colour, caused by the long hair being banded with alternate rings of black and white, but the former has the tail distinctly black-tipped and is nearly twice as long as the latter, which measures, head and body, 13½ inches, tail 10½ inches. They are both plantigrade and the claws are not retractile nor sharp. Mr. Fitzsimons has observed them in captivity and says that if captured very young and handled daily they become perfectly tame, but will not allow a stranger to approach. Several times Puff Adders were put into the cage of the little mungoose and in each instance it succeeded in killing them, so that Rikki-Tikki, need not be ashamed of his South African cousin.

Passing over the dog tribe we come to a section of the Carnivora containing the three families—bears, racoons and weasels—of which the last named only is represented in South Africa, the Family Mustelidae containing the otter, ratel and muishond. It is the black and white Striped Muishond or Stink Cat[14] which has been seen in the vicinity of Kirstenbosch. It has powerful claws on its front feet with which it tunnels into the soil in search of insect food, burrowing down to the retreats of rats and mice to devour both adult and young. It is therefore most useful in keeping down destructive rodents, and is gentle and easily tamed, becoming greatly attached to its owner. When attacked it takes refuge in a hole, bites most savagely and tenaciously and emits an offensive odour from its anal glands. The head and body measure nearly 15 inches, tail about 9 inches. There are four white longitudinal stripes and three narrower black ones.

The most dreaded member of the Order Rodentia is the Blesmol,[15] which is so destructive in the gardens. Unlike the creeping mole it sends up heaps of earth at intervals which mark the line of excavation. The burrows branch from time to time, the main one ending in a somewhat rounded chamber where the animal stores its corms and bulbs, all with the little bud at the top carefully bitten out so that it cannot sprout. It is a plucky little creature and when caught assumes most terrifying attitudes, opening its mouth and showing its large incisors, with which it can inflict a severe bite. The eyes are very small but quite visible and the face very blunt. It measures in all from 8 to 9 inches, and is grey in colour, the head darker.

Both the Field Mouse[16] and the Striped Mouse[17] are common at Kirstenbosch in bushy places among underwood, where the latter form nests among the dried leaves and branches and the former make short burrows. The Cape Hare or Vlackte-Haas[18] is very destructive, eating the growing shoots of small plants, sometimes down to the ground. It is found almost everywhere throughout South Africa, Lepus being the only South African genus of this Family.

Besides the imported squirrel the other rodents observed in our area are the Porcupine,[19] the Black[20] and the Brown Rats[21] and the Cape Gerbille.[22]

Belonging to the Order Ungulata we have probably both the Grijsbok[23] and the Steenbok.[24] The latter is pure brown in colour and the former reddish brown grizzled by numerous interspersed white hairs. The Steenbok is on the whole the commonest and most widely distributed of all South African antelopes. Its height at the shoulder is 20 inches, length 34 inches, the tail with hair 2.25 inches and the horns rarely up to 5 inches. It is more slender than the rather smaller Grijsbok.

The Dassie, Rock Rabbit, Dasje or Klip-dass[25] is placed in a Suborder of the Ungulata. Dasje is the Dutch diminutive for badger, with which it has no relationship at all. The earliest allusion to the Dassie is no doubt that contained in the Bible (Psalm CIV. 18)* referring to the Syrian species. It lives in small family parties in the crannies and cracks of the rocks but not in burrows excavated by itself. The wonderful powers of climbing and clinging to almost perpendicular surfaces which it possesses are due to a special arrangement of the feet. The soles, which are naked, are covered by a very thick epithelium which is kept constantly moist by the secretion of the sudorific glands there very abundant. Furthermore the sole may be contracted to form a hollow air-tight cup. The dassie reposes in its lair during the night, feeds mostly in the early morning and evening and spends the middle of the day basking in the sun. Its food consists entirely of vegetable matter, chiefly the young shoots of shrubs.

L. Bolus.

[11] *Genetta felina.* [12] *Herpestes caffer.* [13] *H. pulverulentus.*
[14] *Zorilla striata.* [15] *Georychus capensis.*

[16] *Mus minutoides.* [17] *Arvicanthis pumilio*
[18] *Lepus capensis.* [19] *Hystrix capensis.*
[20] *Mus rattus.* [21] *M. decumanus.*
[22] *Gerbillus afer.* [23] *Raphicerus melanotis.*
[24] *R. campestris.* [25] *Procavia capensis.*

*" The high hills are a refuge for the wild goats; and the rocks for the conies."

THE BOTANICAL SOCIETY OF SOUTH AFRICA.
ANNUAL REPORT FOR 1920.

THE Council has pleasure in submitting the Ninth Annual Report of the Society.

The sum of £310 19s. 3d. has been available for the purpose of augmenting the funds of the Trustees of the National Botanic Gardens, as compared with the sum of £290 19s. 3d. in 1919.

Largely due to a special appeal made by the President there has been an unprecedented increase in the membership of the Society, which now stands at: Life Members 54, Family Members 45, Members 384, Associates 237—total 720.

The Annual Gathering at Kirstenbosch was held on Saturday, December 4th, and was well attended by members and their friends.

Four meetings of the Council have been held during the year.

At the Annual General Meeting held on April 27th the following were elected as members of the Executive Council for the year:—

Mr. W. Duncan Baxter.
Mrs. F. Bolus.
Mrs. Carter, O.B.E.
Mr. F. E. Cartwright.
Professor R. H. Compton.
Mr. W. A. Eaton.
Miss D. Fairbridge.
Senator The Honourable W. Greenacre.
Mr. H. T. Twentyman-Jones.
Lady Rose-Innes, O.B.E.
Mrs. Brown Lawrence.
Mr. J. Storr Lister, I.S.O.
Mr. E. W. S. Montagu.
Mr. A. H. Reid.
The Honourable Mr. Justice Searle.
Professor D. Thoday.
Mr. A. Walsh.
Mr. W. Webber.
Miss F. M. White.
Mr. A. Williams.

The Right Honourable Sir James Rose-Innes, K.C.M.G., was re-elected President, and Sir Lionel Phillips, Baronet, the Honourable Sir Lewis Michell, K.C.V.O., and Max Michaelis, Esq., Vice-Presidents.

The Council appointed Mr. W. Duncan Baxter as Chairman, Mr. H. T. Twentyman-Jones, Honorary Treasurer, and Mrs. F. Bolus, Honorary Secretary.

The resignation of Mr. Cartwright from the post of Honorary Secretary of the Society was received with universal regret. Mr. Cartwright has served the Society since 1915 with whole-hearted devotion, and the Council, knowing how much of the satisfactory progress of the Society is due to his efforts, wishes to take this opportunity of placing upon record its keen appreciation of the zealous way in which Mr. Cartwright has conducted the affairs of the Society throughout his term of office.

The publication of the Journal for 1920 has again resulted in an interesting number, dealing to a considerable extent with the question of the protection of wild flowers. In this connection a supplementary plate—one of the protected *Iridaceae* of the Cape Province—was issued to all Members and Associates who had joined the Society prior to September 30th, 1920. Thanks are due to the Editor, Professor Compton, and to those who contributed articles, including Mr. R. W. E. Tucker of the South African Museum for a valuable article on spiders. It is hoped that similar articles dealing with other branches of the natural history of Kirstenbosch may be forthcoming from the pen of the specialist, so that the Journal by this means may prove a reliable guide to the right understanding of many of the wonderful and beautiful forms of life that abound at Kirstenbosch.

The rambles over Kirstenbosch, instituted by the Society and conducted by the Honorary Secretary, were attended throughout the school-year by various botany-classes in the Peninsula and other schools, and have been much appreciated. The total number of attendances was 490.

Four holiday-courses in Botany and Nature-Study have also been held under the auspices of the Society, each of one week's duration, viz.: One in April, May, June and September. These were attended by a total of 34 students, most of whom resided at the Hostel at Kirstenbosch for the period of the course.

While the Society feels it has been a privilege to contribute as far as it has done towards the funds of the Trustees of the National Botanic Gardens, it is nevertheless keenly alive to the fact that more members and still more members must be enrolled in order to supplement the funds needed for the development of the Gardens, knowing that by this means most of all can the Society assist in this truly national work. Let each member, then, do his best to get the form which accompanies this Report duly signed and posted together with the subscription, the payment of which constitutes membership. If all are successful the present membership would be doubled, and the Botanical Society would hold the proud position of being the largest Society of this nature in South Africa—a Society actuated and bound together by love for one of the most beautiful and interesting portions of our land.

The Council desires to express cordial acknowledgments of its obligations to Mr. R. L. McDonald for auditing the accounts, to the City Council and the South African Association for the use of rooms for meetings, and to the Press for valuable assistance in reporting matters of interest, and calling attention to the work of the Society.

W. DUNCAN BAXTER,
Chairman of Council.

L. BOLUS,
Honorary Secretary.

CAPE TOWN,
March 3rd, 1921.

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Kirstenbosch, Newlands, Cape.

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The following seeds are available for distribution or exchange to Members and Associates of the Botanical Society of South Africa, and to Botanical Gardens. Application should be made to the Director.

AFRICAN SPECIES.

Acacia giraffae.
,, spirocarpoides.
Acrotoma inflata.
Acokanthera spectabilis.
Albuca major.
,, sp.
Aloe plicatilis.
,, Pretoriensis.
,, rubrolutea.
,, sp.
Anacampseros Telephiastrum.
Anoiganthus breviflorus.
Antholyza praealta.
,, paniculata.
Arctotis aspera.
,, elatior.
Asclepias affinis.
,, Burchellii.
,, fruticosa.
Aspalathus capitata.

Babiana disticha
,, sp. (near disticha).
,, macrantha.
,, sp.
,, stricta.
,, stricta var. angustifolia.
,, stricta var. rubro-cyanea.
,, stricta var.
,, tuliflora.
,, villosa.
Begonia Dregei.
Berkheya sp.
Berzelia sp.
Brabeium stellatifolium.
Brachystelma Gerrardi.
,, Meyeri.

Calpurnia villosa.
Cardiospermum Halicacabum.
Cedrus atlantica.
Ceropegia Randallei.
Chaetachme aristata.
Cleome diandra.
Cotyledon sp.
Crinum longifolium.
,, Moorei.
Crotalaria capensis.
Cucumis africanus.
,, metaliferus.
,, myriocarpus.
Cyrtanthus lutescens.
Cytisus candicans.

Dianthus incurvus.
Dierama pendula.
,, pulcherrima.
Dodonaea Thunbergiana.

Empleurum serratifolium.
Encephalartos Altensteinii.

Felicia capensis.
,, sp.
Ferraria undulata.

Gerbera discolor.
,, Galpinii.
,, Jamesonii.
,, Kraussii.
,, Krebsiana.
Gladiolus alatus.
,, angustus.
,, callistus.
,, carmineus.
,, cuspidatus.
,, cuspidatus var. ventricosus.
,, quartinianus.
,, sp. "Rumana".
Greyia Sutherlandii.

Haworthia margaritifera.
,, sp.
,, tessellata.
Helichrysum sp.
Helipterum speciosissimum.
Hibiscus diversifolius.

Indigofera cylindrica.
Ixia columella.
,, flexuosa.
,, maculata.
,, polystachya.
,, scariosa.

Lachenalia orchioides.
,, pustulata.
,, sp.
,, unifolia.
Lasiospermum radiatum.
Leucadendron argenteum.
Liparia sphaerica.
Lophira alata.
Luffa sp.

Melothria oclaknia.
Momordica cordifolia.
Moraea bicolor.
,, iridioides.

Nemesia barbata.
Nesaea floribunda.

Ochna atropurpurea.
Ornithogalum Eckloni.
,, sp.

Peucedanum Galbanum.
Pelargonium betulinum.
,, inquinans.
,, viscosissimum.
,, zonale.
Phygelius capensis.
Pittosporum viridiflorum.
Pogonarthria falcata.
Podocarpus latifolius.
Podranea Brycei.
Priestleya capitata.
Pseudogaltonia Pechuelii.

Rafnia triflora.
Ricinus communis.
Rumex Ecklonianus.

Scabiosa sp. (pink and mauve).
Schizoglossum longors.
,, Reitforbii.
Scilla natalensis.
Sesamum indicum.
Sparaxis grandiflora.
,, grandiflora var.
,, grandiflora var. atropurpurea.
,, purpurea.
,, sp.
Sparmannia palmata.
Spathodea nilotica.
Stapelia flavirostris.
,, nobilis.
Sutherlandia frutescens.

Tecoma Smithii.
Tephrosia Vogelii.
Tritonia Mathewsiana.
,, scillaris.

Ursinia tenuifolia.

Vaugueria infausta.
Veltheimia Deasii.
,, glauca.
Virgilia capensis.

Wachendorffia thrysiflora.
Watsonia marginata.
,, meriana.
Widdringtonia cupressoides.
,, Schwarzii.
,, Whytei.

Xysmalobium confusui.
,, ensifolia.

EXOTIC SPECIES

Acacia Benthamii.
,, decurrens.
,, juniperina.
,, longifolia.
,, longifolia var. floribunda.
,, melanoxylon.
,, mollissima.
,, myrtifolia.
,, penninervis.
,, pycnantha.
Albizzia lebbek.
Antigonon leptopus.

Areca Baueri.
,, sapida.
Argyreia speciosa.

Begonia semperflorens.
Bignonia Unguis-cati.
B. rassus flabellifer.
Brachycome iberidifolia.
Butea frondosa.

Callistemon lanceolatus
,, rigidus.
Cassia artemisioides.
,, auriculata.
,, australis.
,, bonariensis.
,, bicapsularis.
,, corymbosa.
,, eremophila.
,, fistula.
,, floribunda.
,, glauca.
,, hirsuta.
,, laevigata.
,, obovata.
,, occidentalis.
,, tomentosa.
,, tora.
Casuarina equisetifolia.
Cedrela Toona.
Ceratopetalum gummiferum.
Cistus hirsutus.
,, ladaniferus.
,, laurifolius.
,, populifolius.
,, salvifolius.
,, salvifolius var. macrocalyx
Clausena inequalis.
Clematis aristata.
Cleome spinosa.
Conospermum ericifolium.
,, taxifolium.
,, tenuifolium.

Crotalaria alata.
,, ferruginea.
,, Grantiana.
,, incana.
,, laburnifolia.
,, polysperma.
,, sericea.
,, striata.
,, retusa.
,, usambariensis.
,, verrucosa.

Dolichos Lablab.

Eucalyptus acmenioides.
,, alpina.
,, aristoana.
,, Baileyana.
,, bicolor.
,, botryoides.
,, Conrideneana.
,, elaeophora.
,, Morrisii.
,, radiata.
,, Risdoni.
,, Smithii.
,, variegatum.

Grevillea Banksii.
,, Banksii var. Forsteri.
,, buxifolia.
,, linearis.

Hakea dactyloides.
,, eriantha.
,, Kippistiana.
,, sericea.
,, verrucosa.
Hardenbergia monophylla var. fruticosa.
Hibiscus esculentus.
,, trifoliatus.

Indigofera australis.
,, cylindrica.
Isopogon anethifolius.
,, anemonifolius.

Jacaranda mimosaefolia.
Juniperus cedrus.

Kennedya rubicunda.

Lolium italicum.
Lomatia Fraseri.
,, longifolia.

Macadamia ternifolia.
Melia sempervirens.
Momordica cochinchinensis.

Oxylobium ellipticum.

Pandorea australis.
Persoonia Caleyi.
,, linearis.
Petrophila pedunculata.
,, sessilis.
Pinus canariensis.
Pittosporum undulatum.
Pleiogynium solandri.
Poinciana regia.
Prosopis juliflora.

Rhopalostylis sapida.

Securidaca longipedunculata.
Stenocarpus sinuatus.
Sterculia acerifolia.
Strangea linearis.

Telopea speciossima.

Wigandia caressana.

SOME RECENT PUBLICATIONS.—*Continued from Page 10.*

from drawings by Miss K. A. Lansdell of the Division of Botany, each with a description of the plant illustrated and explanatory notes, the text being written by Dr. Phillips, Botanist in Charge of the National Herbarium. Mr. N. E. Brown is seeing the publication through the press (Reeve) in England. Following the suggestion of the late Dr. Pearson, native plants are now cultivated in considerable numbers in the gardens of the Union Buildings, Pretoria, and many of the plates are drawn from specimens flowered there. Many of the species depicted are well known to botanists and gardeners—about half have been illustrated previously, some more than once: the others comprise less familiar plants and there are a few new species here published for the first time. (*Arctotis Forsteri* N.E.Br., *Cyrtanthus contractus* N.E.Br., *Leucadendron Stokoei* Phill. and *Senecio stapeliaeformis* Phill.). There are unfortunate discrepancies between plates and text in Numbers 3, 4, 11, 12, 15, 28 and 29: these could be avoided in future by the omission of the name of the plant on the plate itself. The colouring does not do justice to Miss Lansdell's drawings or to their subjects, but this is unavoidable in the present stage of evolution of colour-reproduction. The cover-quotation is hardly apposite. Apart from these criticisms we have great admiration for this new enterprise, which, financially, has been possible through the generosity of a South African lady who remains anonymous.

* * *

We understand that a new part of the *Annals of the Bolus Herbarium* is in the hands of the printers and may be expected shortly.

* * *

Mrs. Arber's new book on *Water Plants* (published by the Cambridge University Press) is a model presentation of facts and theories on this most interesting biological group. The aquatic habit is convincingly shown to have originated independently in many distinct families of Flowering Plants, which in general are a terrestrial group: and Mrs. Arber considers that these aquatics are not mere weaklings crowded out and taking refuge in a supposedly "soft" environment, but rather pioneers colonising a new habitat and solving its novel problems in, as it were, an adventurous spirit. Most water plants are a curious blend of features clearly adapted to their new habitat and of other features obviously inherited from their terrestrial ancestors. The book is suggestive and stimulating, and at the same time the three indexes make it an invaluable means of reference to the vast specialist literature on the subject of Angiosperm water life.

The Collection of Specimens for Kirstenbosch.

MEMBERS of the Society are invited to assist in stocking the Gardens with native plants. Specimens from all parts of Africa are desired. At present representatives of the following are particularly needed: *Aloes, Bulbs, Ferns, Proteas* (seeds), *Heaths* (branches bearing old flowers), *Succulents, Woody Leguminosae,* medicinal, aromatic and other economic plants.

From places within the Union (including S.-W. African Protectorate) consignments can be sent free by rail (S.A.R. and N.C.C.R.) or post if addressed:

BOTANICAL SPECIMENS, O.H.M.S.

To

THE DIRECTOR,

National Botanic Gardens,

Kirstenbosch,

Newlands, Cape.

From Northern and Southern Rhodesia seeds and plants may be sent by post at Sample Rate, without preliminary inspection or fumigation.

INSTRUCTIONS FOR PACKING AND SENDING SPECIMENS.

Cotyledons, Crassulas, Euphorbias, Aloes, Stapelias, Mesembrianthema and other plants of a like succulent nature, and also the *Epiphytic Orchids,* should be packed dry. Each species should be wrapped in paper and laid tightly in a box. Large specimens of *Aloes, Euphorbias, Cycads,* etc., may be trucked loose.

Large specimens of Tree Ferns should be bound in wet grass or canvas, or with a little damp moss inside the canvas, and the stems should be strengthened with poles.

Ferns, Bulbous and Tuberous Plants in growth and flower need a little damp moss among the roots.

Distinct species of dormant bulbs and tubers, as well as of seeds, should be sent in separate wrappers.

Each consignment should bear (1) the name and address of the sender; (2) the locality in which the specimens have been gathered. Brief notes as to habitat (wet, dry, sun, shade, sand, clay, and so on) are most valuable.

Contributors of economic plants are requested to send particulars as to their properties and the methods of using them.

Common as well as rare species will be welcome. Fully addressed labels can be had on application.

The Botanical Society of South Africa.

OBJECTS:

(*a*) To encourage the inhabitants of South Africa to take an active part in the progress and development of the National Botanic Gardens at Kirstenbosch, a part of the Groote Schuur Estate, in the Cape Province, and to induce them to appreciate their responsibilities therein.

(*b*) To augment the Government grants towards developing, improving, and maintaining fully equipped botanical gardens, laboratories, experimental gardens, etc., at Kirstenbosch.

(*c*) To organise shows at which may be displayed the results of botanical experiments or cultural skill in improving the different varieties of South African flora.

(*d*) To enlighten and instruct the members on botanical subjects by means of rambles, meetings, lectures, and conferences, and by the distribution of literature.

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Those wishing to become members of the Society are invited to communicate with Mrs. F. BOLUS, Hon. Secretary, P.O. Box 70, CAPE TOWN

CAPE TIMES LTD

THE JOURNAL OF THE BOTANICAL SOCIETY OF SOUTH AFRICA

Edited by R. H. COMPTON, M.A., F.R.S.S.Af., Hon. Director, NATIONAL BOTANIC GARDENS :: :: :: KIRSTENBOSCH :: :: ::

Part VIII. 1922

Published under the authority of the Council of the Botanical Society

Cambridge University Press

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The Journal of the Botanical Society of South Africa.

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PLATES.

South African Geraniaceae. By Miss M. M. Page.

Sketches in Kirstenbosch. By G. J. Porte.

Details of the Structure of Heaths. By Miss M. M. Page.

NOTES AND NEWS.

The Membership of the Botanical Society shows a further increase, which is specially gratifying in view of the depressed financial conditions which have recently prevailed. The following table shows the growth of Membership since the inauguration of the Society :—

	Life	Family	Ordinary	Associates	Total
1914.. ..	33	22	264	33	352
1915.. ..	46	26	263	32	367
1916.. ..	49	26	264	45	384
1917.. ..	46	24	249	53	362
1918.. ..	49	28	281	78	436
1919.. ..	50	38	320	84	492
1920.. ..	54	45	384	237	720
1921.. ..	54	48	407	287	795

If this rate of increase is maintained, the Botanical Society should soon become the largest Society of a scientific nature in South Africa. (The South African Association for the Advancement of Science, which holds the premier position at present, had 893 on its roll in 1921.) As the President remarked in his address on moving the Annual Report, the Society should aim at a membership roll of 1,000. It should not be difficult to do this. In fact, if every Member and Associate, on reading this, were to make a point of asking a friend to join the Society on the same day, the thousand would certainly be quickly reached.

* * *

At the Annual General Meeting of the Society held on 28th April, a motion to restrict Associateship in future to teachers and scholars only was negatived. It has been clear that for some time the subscription of 5s., while it covers the cost of the Journal, Annual Reports, circulars, postage, etc., does little more. Associates, just as Members, have the privilege of obtaining surplus material from Kirstenbosch free of charge on application ; and this right, however willingly granted, entails work on the part of the Gardens staff. It is greatly to be hoped that all Associates who can see their way to doing so should become full Members and so give the Gardens a clear balance from their subscriptions : the primary aim of the Society being altruistic and patriotic, namely, to support the national work on the South African flora now being carried on at Kirstenbosch.

* * *

The issue of Part III. of this Journal is now exhausted. The Hon. Secretary will be greatly obliged if any member who has a surplus copy of this Part will kindly send it to her, as she is receiving enquiries for it to complete sets.

* * *

Members and Associates who change their address are requested to notify the Hon. Secretary, as otherwise it is impossible to ensure the delivery of the Journal and other publications.

We are glad to be able to report the formation of societies for protecting wild flowers in Oudtshoorn and Caledon. These societies are affiliated with the Wild Flower Protection Society in Cape Town and are taking steps to check the appalling devastation of the native flora that is taking place. From Caledon a correspondent writes : "You will scarcely credit it, but during the season last year one coloured man had a turnover of £300 a month dealing in wild flowers. He sent an average of 30 petrol tins a day to the Transvaal and even as far afield as to Australia. For this he had to pay a licence of 5s. He had coloured scouts all over the district collecting heath and rare proteas for him.' This is one instance of many. The law is powerless to check these depredations in the case of "unprotected" species, and does not exert its full powers in the case of the "protected" ones. No wonder the face of the south-western veld is changing and its glories are becoming a mere memory.

* * *

In conversations about flower protection two remarks recur with terrible regularity : (1) "When I was a boy girl, the whole place was thick with—— (Painted Ladies, Flames, Afrikanders or what not). We used to bring home huge bunches. Now you hardly ever see them." *Post hoc et propter hoc.* (2) "Oh, there's no need to protect——. There are masses of it at——." These two sentences will probably be inscribed on the two sides of the medal which will be coined to commemorate, say, the first twenty species of Cape Wild Flowers to become extinct through picking, and which cannot now be very long delayed.

* * *

Perhaps the most important aromatic plant in cultivation is *Mentha piperita*, the Peppermint. A very promising experimental plot of this plant has been established at Kirstenbosch and last year Members of the Botanical Society were given first chance of obtaining material for trial on their own ground—a privilege of which some few availed themselves. This year a larger supply is available—though not now exclusively to Members—and application should be made to the Director of the National Botanic Gardens. It is understood that a brief report on the success of the culture will later be sent in.

* * *

Atropa Belladonna, the Deadly Nightshade, is a medicinal plant of great importance, and one which promises to be successful in cultivation in South Africa. A packet of seed will be sent to any Member on application to the Director of the National Botanic Gardens, the understanding as to a report being sent in later applying as in the case of the Peppermint. It is specially desired to try Belladonna on calcareous soil, and any Member who lives on a limestone formation will be making a valuable experiment if he will undertake a trial plot.

One is constantly being reminded of how little is known of the South African native flora, as distinct from aliens of recent introduction. It is true that many aliens are apparently more at home here than in their country of origin—which things are a parable—but surely there is no excuse for the following verse from a poem called "Africa" prefaced to a popular book of South African stories :—

"O! come where stephanotis grows,
And where the pomegranate breaks blood-red.
Come where the cruel cactus blows
And pungent aloes are outspread.
I cannot offer gentle flowers,
Only these strange and fateful blooms," etc.

Stephanotis occurs in Cuba, Malaya and Madagascar. The pomegranate is native from the Balkans to the Himalayas. The cruel cactus blew originally in America (unless the authoress intended *Rhipsalis*, which we doubt). And as for the aloes, we more than suspect that she was thinking of the plant so called in the photograph in the railway compartments, namely *Agave americana*. This last-named plant also holds a prominent place in the design of the new South African bank-note, where it is associated with what appears to be our old American enemy the prickly-pear and various other strange and fateful blooms.

Finally we challenge our authoress to name any country richer in "gentle flowers" than South Africa. If she will pay Kirstenbosch a visit . . .

* * *

We may also recall the hero of the South African novel who lay down to sleep in the shade of a karoobos and marked the place in his book with a leaf of the prickly pear. Then there is the "beautiful purple coloured flower that emits a powerful odour to attract flies and then remorselessly sucks the life from the dazed insect" which is said, in a recent newspaper article, to be one of the many wonders of Kirstenbosch. Will not someone write an article on the "Flora of our Dreams"?

* * *

In the present number of the Journal we publish an article by Mrs. Bolus on the South African Heaths, and an article by the Curator of Kirstenbosch on their cultivation. The Heath Garden at Kirstenbosch is as yet in an early stage of development, and perhaps few visitors have found it. The section so far developed lies on the south-eastern slope of the Kaffir Boom Knoll on the left bank of the Nursery Stream. In time it will be extended through the swamp between Skeleton Gorge Path and the Arboretum, and a great variety of soils will then be available. At present the chief difficulty about growing the Cape Heaths is in obtaining good seed from the wild plants. Members are specially requested to send in any Heath seeds they may be able to collect. It must be remembered, however, that in most cases *the seed is shed before the corollas fall.* The safest way is to cut branches bearing withered flowers and enclose them in paper bags. The whole bagful can then be sent to Kirstenbosch without troubling to clean the seeds. Contributors should state the kind of soil, degree of moisture, etc., as this makes a great difference in cultivation.

An article on the South African Geraniaceæ is also appearing in the present issue, together with some notes on their cultivation. The genera Pelargonium and Oxalis are well represented at Kirstenbosch, a site having been set apart for this Family since the first inception of the Gardens. It is now greatly desired to add to the collection of Oxalis—the "zurings" which so brightly carpet the veld during the winter—and Members will be doing a service by sending in plants. They can be dug up while in flower, care being taken to obtain the "pips" or bulbs. Not less than 25 of each kind should be sent, and hundreds will be acceptable.

A key to the species of Geraniaceæ on the Cape Peninsula is included in Mrs. Bolus' article. This will be valuable to the nature-student and botanist : and we can also strongly recommend the process of "running down a species" to those who collect wild plants for their gardens and want to take an intelligent as well as an aesthetic interest in them.

* * *

In continuation of the series of natural history articles we publish some notes on the caterpillars of Kirstenbosch in the present Part. There is enormous opportunity for study of the most fascinating kind on this strange stage in the life history of our moths and butterflies. In the next Part we hope to publish an article by Mr. C. J. French on the Snakes and Lizards, a subject of which he has a unique knowledge.

* * *

We are glad to publish three letters recording observations on certain points in the life and habits of some of the creatures that live at Kirstenbosch. These letters are the outcome of the nature study classes that have been conducted by Mrs. Bolus on behalf of the Botanical Society, and of the articles on natural history subjects which have appeared in this Journal. We shall welcome any future letters of the same kind, and we only make one proviso—they must be records of the writer's own observations and are not to be taken from books or secondhand from someone else.

* * *

A book of photographic plates is in preparation, and should be ready shortly, illustrating various beautiful native plants grown at Kirstenbosch together with views taken in the Gardens. Some of the plates have already appeared in "South African Gardening" by the courtesy of the Editor : and the same publishers, namely, the Specialty Press, are undertaking the book of plates, which will be produced in an elegant style and will be admirably suited for a gift book or as a memento of the Gardens.

* * *

Reprints of the beautiful pen and ink drawing by Miss M. M. Page of the Panorama as seen from the Kirstenbosch Contour Path are still obtainable, price 1s. 7d. post free from the Director of the National Botanic Gardens. The drawing was published as a folding plate in the 1919 issue of this Journal. The names and altitudes of all the most conspicuous mountain peaks are given as well as indications of the principal features in the foreground and middle distance. The picture is really a key to one of the most beautiful landscapes in the world, and is a most interesting companion for anyone who visits Table Mountain.

SOUTH AFRICAN GERANIACEAE.

GERANIUM is perhaps one of the earliest plant-names most of us learn. It is associated in our mind with a comfortable-looking plant, having clusters of red or pink flowers and ample roundish leaves, soft to the feel, with or without a dark zone somewhere in the middle. We were not forbidden to touch it, nor even to taste it, and to smell the "scented geranium" was always a delight. And if in our romps we broke off pieces, well—it didn't really matter: we had only to plant them and they would "always grow again." In later life we learned that our favourites were not geraniums at all, but pelargoniums; and when we are on our best behaviour we, of course, use the correct term, *Pelargonium*, to designate members of this genus. Yet in our heart of hearts we, like Wordsworth's little cottage-girl, would have our will, and would cherish the old friendship under the old pet name to the end.

It is indeed an old name, Geranion (geranos=a crane) having been used by Dioscorides in the first or second century A.D. to indicate a plant whose pointed beak-like fruit his fancy likened to a crane's bill. This delightful fancy has come down to us, and the Greek name has persisted, at one time embracing as well what L'Héritier, in the eighteenth century, separated into the two genera, *Pelargonium* or stork's-bill and *Erodium* or heron's-bill. About the same time *Monsonia* (after Lady Ann Monson whom Harvey describes as "a lady of considerable botanical taste and acquirements") was established, and a few decades later *Sarcocaulon* or fleshy-stem, a closely-allied genus, was added to the number. *Oxalis* or sour-juice is by some authorities considered sufficiently distinct to constitute a Family of its own, *Oxalidaceae*, but in accordance with Bentham and Hooker's classification we have included it in the *Geraniaceae*.

* * *

Distribution.

By far the largest genus is *Oxalis*, consisting of over 300 species, of which nearly half are to be found in South Africa, the rest being natives chiefly of extra-tropical South America, where "some of the species form rather tall shrubs—the rod-like stems of one being used to make a sort of wicker-work skeleton of houses." *Geranium* comes next, with about 239 species. It is cosmopolitan, especially in temperate regions. South Africa possesses some six or seven native species, chiefly inhabiting the eastern districts. The commonest species on the Peninsula is *G. incanum*, L., or the hoary Geranium, scrambling lightly over grass and bush in cool places, and flowering in spring and all through the summer where conditions are favourable. The foliage is hoary beneath and green above, except that later the red and crimson touches burn in the tangle when we find:—

> "Autumn laying here and there
> A fiery finger on the leaves."

Pelargonium, another very large genus (about 227 species) is almost exclusively South African, ranging from west to east and from south to north in a most bewildering variety of forms, and showing endless examples of the most perfect adaptation to environment. *Erodium* (about 60 species) is represented by a very beautiful little plant, *E. incarnatum*, common in the Caledon Division, with bright red-crimson flowers and roundish deeply cut-up leaves; as well as by two or three other species, probably all imported, which have become weeds of cultivation. *Monsonia* (29 species) is widely distributed in South Africa, the beautiful *M. speciosa* being very common in the Stellenbosch Division and elsewhere in the south-west. Others occur in Namaqualand, Transvaal and the Eastern Province, Natal, Egypt, and in Persia and India. *Sarcocaulon* (6 species) is entirely South African, and inhabits the drier regions only, chiefly the Karroo, Namaqualand and Hereroland.

* * *

Description.

Many are evergreen perennials—some woody enough to be regarded as shrubs, but by far the greater number falling into the class of herbs, like the scented-leaved Pelargonium (*P. capitatum*), or the succulent *Pelargonium carnosum* and species of *Sarcocaulon*. Others, again, die down above ground, and have an underground resting-stock—either bulbous, as in *Oxalis*, or tuberous, as in Pelargonium (Plate One, VI., 1, 2, 3).

The erect habit of growth is more usual, the decumbent habit frequent and the scrambling habit rare. The "Gouty Pelargonium" (*P. gibbosum*), which scrambles among shrubs near the coast, on the Peninsula, and the "Ivy-leaf Pelargonium" (*P. peltatum*), from the Eastern Province, suggest themselves as the most striking examples. No epiphytes are known. Except the "Water-Oxalis" (*O. natans*) there are no hydrophytes in the Family, although many favour damp places. The great majority show distinct xerophytic characters—either storing up water in their stems or leaves or dying down above ground during the dry season, or, if evergreen, clothing their leaves and stems with hairs or a thick cuticle, or a resinous covering. In *Sarcocaulon* the petioles of the leaves on the main branches elongate and harden into thorns (I, 11) which persist and perhaps serve as a veil against excessive heat and light; and in some species of *Pelargonium* the peduncles persist and become spinous. In their method of obtaining food all members of the Family are independent.

The leaves (I, 1-16) are nearly always arranged spirally, and it is rarely that one finds a sessile leaf, or, except in *Oxalis*, one without stipules. The veining is of the netted type—either palmately or pinnately—and infinite variety is exhibited in the shape of the blade, which may be linear, oblong, ovate or round,

with every possible degree of cutting—ranging from a mere toothing on the margin to a deep division almost reaching the midrib. Palmately compound leaves are the rule in *Oxalis*.

The flowers may either be arranged in close clusters (congested cymes) or in loosely-branched inflorescences, or they may arise singly, as in many species of *Oxalis*. They are usually regular (II, 1-5), or in *Pelargonium* have the back sepal and the two back petals larger than the rest, and the stamens and style declining from the centre of the flower (II, 6-7). The parts are arranged in fives, and both the sepals and the petals are free from one another. The stamens (III, 1-7) and carpels (IV, 1-6), however, are more or less united. In *Oxalis* and *Geranium* there are five short and five long stamens; in *Pelargonium* some, and in *Erodium* all, the short ones are reduced to staminodes; and in *Sarcocaulon* and *Monsonia* the short ones appear to have branched into two, so that ten short stamens are represented. The anthers consist of two lobes and shed their pollen by longitudinal slits. At the base of the long stamens in *Sarcocaulon, Monsonia,* and *Geranium,* or at the base of the short stamens in *Erodium* are the spheroid glands which produce the honey. These have not been observed in *Oxalis,* and in *Pelargonium* the back sepal is specially adapted to form a nectary. It is drawn out at the base into a slender tube which fuses with the pedicel, and varies in length in the different species.

In *Oxalis* the five styles as well as the five knobbed stigmas are free, and the cells of the ovary have two or more ovules, but in all the other genera only the linear stigmas are free (IV), and the cells of the ovary have only one ovule each.

* * *

Seed Dispersal. The fruit is dry and the dispersal of the seed is effected either by the explosive mechanism (sling-fruits), as in *Oxalis* and *Geranium,* or by wind as in the other genera. In *Oxalis* (V, 1) the fruit is capsular, and the seed has an extra fleshy covering (aril). "When ripe the cells of the inner layer are extremely turgid, and a small disturbance causes the aril to turn inside out instantaneously, and the seed is shot out." In *Geranium* the whole carpel is released at the base and springs up with a jerk which sends the seed some distance from the mother-plant (V, 4). The mechanism in the other genera is still more interesting, for here we have an instance of plants sowing their own seeds. The carpels separate themselves from the receptacle, beginning either at the bottom or the top—each carpel consisting of the ovary and a long bristle or awn, derived from the style (or, as some authorities state, from the beak-like receptacle). This awn, which is provided with hairs forming a plume to catch the wind, as it dries, twists in a spiral. When the heavier seed-end strikes the ground the sharp-pointed base penetrates the soil. The awn which is hygroscopic untwists in the damp weather, and so tends to screw into the ground the seed-end, whose ascending hairs facilitate the movement and, on the other hand, prevent the seed from being too easily withdrawn from the ground.

Pollination. The attractiveness of the flowers in this Family and the ample provision of honey unquestionably indicate that cross-pollination is effected, and the shape of the flowers clearly point to insects as the pollinating agents. We find that this is ensured in two ways. All the genera but *Oxalis* have the pollen mature, and even shed, before the stigmas of the same flower open out for pollination, so that no flower is fertilised by its own pollen. The stamens, moreover, will turn outwards, or, in the case of *Pelargonium,* bend downward as the stigmas rise to take up the position thus vacated. In *Oxalis* the pollen and the stigma are ripe at the same time but there are three forms of flower—one with a short style, one with a medium, and one with a long style, with medium and long, short and long, and short and medium stamens, respectively. The first form with the short style is pollinated only by the second and third forms which have short stamens; the second form with the medium styles only by the first and third forms; and finally the third only by the first and second forms of flower.

* * *

Movements. "Sleep-movements" are exhibited in the leaves and flowers of *Oxalis* and in the flowers of all the other genera but *Pelargonium,* where the pollen is effectually protected by the projecting larger upper petals.

* * *

Uses. Besides holding an important place in horticulture, this Family provides several South African species which are of economic value. The scented-leaved *Pelargonia* are used in the manufacture of perfumes, especially *P. odoratissimum* and the common *P. capitatum,* which is grown largely in the South of France. *Geranium incanum* and *Pelargonium reniforme* are used as tonics or bergtee, and the roots of the latter and those of *P. antidysentericum* and *P. pulverulentum* (this said to be the main constituent of a certain proprietary remedy for consumption) are used medicinally. *Oxalis* produces oxalic acid.

* * *

Summary. Shrubs, or more or less perennial evergreen herbs, or herbs with perennial rootstock and annual shoots, very rarely annual herbs; erect, decumbent, or rarely scrambling; xerophytes, tropophytes, mesophytes, or very rarely hydrophytes; independent; polypetalous. Leaves arranged in spirals, sessile or petiolate, stipulate or exstipulate, simple or compound, palmately or pinnately netted-veined, linear, oblong, ovate, or orbicular, acute, obtuse, or emarginate, tapering, rounded, or cordate at base, entire, toothed, lobed, or partite, glabrous or pubescent; inflorescence definite—usually a congested cyme of one to many flowers; flowers actinomorphic or zygomorphic, pentamerous, 5-whorled, perianth sepaloid and petaloid, aestivation imbricate (contorted or with one petal wholly out, one wholly in, and three half in and half out); calyx polysepalous, persistent; petals deciduous; stamens erect or declinate, monadelphous or partially so; anthers 2-lobed, dehiscing by longitudinal slits; gynaeceum superior, syncarpous, carpels

1—several-ovuled; fruit a capsule or schizocarp, adapted to dispersal by wind or sling mechanism; cross-pollination effected by insects, ensured by dichogamy (protandry) and heterostyly.

* * *

All the genera but *Monsonia* and *Sarcocaulon* are represented in the native flora of Kirstenbosch, especially *Pelargonium* with about twelve species and *Oxalis* with eighteen species.

The following are keys for identifying the Cape Peninsula genera and species in the field. Those species marked with an asterisk occur wild at Kirstenbosch.

Flowers regular.
 Stamens 10 (some or all bearing anthers).
 Fruit splitting up into 1-seeded portions (schizocarp).
 All stamens perfect **Geranium.**
 Five stamens barren **Erodium.**
 Fruit a capsule **Oxalis.**
 Stamens 15.
 Stems fleshy; stamens united at base **Sarcocaulon.**
 Stems not fleshy; stamens in five bundles **Monsonia.**
Flowers irregular **Pelargonium.**

MONSONIA.

ovata, Cav.

GERANIUM.

Leaf-segments linear or oblong.
 Petals longer than the sepals .. **incanum,** L.*
 Petals shorter than the sepals .. **dissectum.** L.*
Leaf-segments ovate or deltoid **ornithopodum,** E. & Z.

ERODIUM.

Leaves cordate-ovate, not cut to the mid-rib **malachoides,** Willd.
Leaves oblong, cut to the mid-rib into distinct leaflets **moschatum,** Willd.*

PELARGONIUM.

Rootstock tuberous, usually covered with rigid tunics.
 Stems not appearing above ground; leaves usually less than 3 ins. wide.
 Petals 5.
 Leaves usually pinnately compound.
 Leaflets entire or rarely with one or two divisions.
 Leaflets lanceolate or ovate, rather acute; petals with a deeply-coloured spot in the middle **astragalifolium,** Pers.*
 Leaflets broadly ovate, obtuse; petals with deeply-coloured veins **pinnatum,** L.*
 Leaflets cut up into numerous narrow segments **rapaceum,** Jacq.
 Leaves not compound, usually deeply cut, or cut and entire on the same plant.
 Entire leaves usually not present, leaf-segments narrow-linear, often 1 in. long **barbatum,** Jacq.
 Entire leaves usually present, leaf-segments linear or ovate.
 Leaves hirsute with long white hairs **hirsutum,** Ait. and var. **melananthum,** Harv.
 Leaves glabrescent or shortly pubescent.
 Leaves ovate, oblong, or lanceolate, tapering at both ends.
 Umbel 3—9-fld. **longifolium,** Jacq.*
 Umbel 10—20-fld. **angustifolium,** Thunb.
 Leaves sub-rotund, often 3-lobed **revolutum,** Andr.
 Petals 2 **marginatum,** R. Knuth.
 Stems appearing above ground, prostrate or scrambling; leaves usually 3 ins. or more wide.
 Stems long and scrambling, much swollen at the nodes; leaves nearly glabrous **gibbosum,** Willd.
 Stems not as above; leaves usually densely pubescent.
 Leaves cordate at base, 3-lobed, 3-partite, or 3-foliolate **lobatum,** Willd.
 Leaves pinnately decompound.
 Ultimate leaf-segments ½ l. wide **flavum,** Ait.
 Ultimate leaf-segments more than ½ l. wide **triste,** Ait.*
Rootstock not tuberous.
 Stems thick, older parts bearing the persistent hardened petioles with adnate stipules; leaf-segments very fine and hairy **hirtum,** Jacq.
 Stems and leaves not as above.
 Nerves on the sepals dark and conspicuous.
 Perennial; upper petals much longer than the lower.
 Leaves canescent and silky on both sides **candicans,** Spreng.
 Leaves glabrous or pubescent, not silky **myrrhifolium,** Ait.* and vars.
 Annual; lower petals nearly as long as upper petals .. **senecioides,** L'Hérit.
 Nerves on the sepals not dark and conspicuous.
 Leaves usually zoned.
 Two upper petals not broader than the lower **zonale,** Willd.
 Two upper petals broader than the lower.
 Leaves glabrous; petals pink or crimson.
 Herbaceous; upper petals about ½ in. long .. **saniculifolium,** Willd.
 Shrubby; upper petals about ¾ in. long **Dodii,** Knuth.
 Leaves pubescent; petals usually cream.
 Stipules cordate-ovate, acute **alchemilloides,** Willd.*
 Stipules lanceolate **tabulare,** L'Hérit.*
 Leaves not zoned.
 Pedicels 1—1½ ins. long; petals yellowish **multifidum,** Harv.
 Pedicels less than 1 in. long; petals pink.
 Upper petals less than 4 ls. long.
 Leaves roundish, glabrous **grossularioides,** Ait.*
 Leaves ovate or oblong, pubescent **chamaedryfolium,** Jacq.*
 Upper petals more than 4 ls. long.
 Leaves cordate at base, petiole usually as long as or longer than blade.



M. M. Page del

South African Geraniaceae.

Leaves often cup-shaped; upper petals usually 1 in. or more long **cucullatum,** Ait.*
Leaves not cup-shaped; upper petals usually ¾ in. or less long.
Larger leaves divided beyond the middle, sweet-scented **capitatum,** Ait.*
Larger leaves not divided beyond the middle, strongly aromatic, the glands clearly visible **vitifolium,** Ait.*
Leaves not cordate at base, petiole usually shorter than the blade.
Leaves ovate-oblong, rarely more than 1 in. long **betulinum,** Ait.*
Leaves as broad as, or broader than, long, usually 2 ins. long **angulosum,** Ait.

OXALIS.

Peduncle 1-fld.
Leaflet 1 **monophylla** L.
Leaflets 3.
Leaflets divided to the middle or beyond **bifida,** Thunb.*
Leaflets entire or emarginate.
Petals white or pale with a conspicuous red margin on the outside.
Stem well-developed above ground.
Hairs gland-tipped; leaflets obovate **multicaulis,** E. and Z.
Hairs not gland-tipped; leaflets linear or linear-cuneate.
Leaves subsessile, leaflets usually ½ l. wide .. **tenuifolia,** Jacq.*
Leaves distinctly petiolate, 1 l. or more wide.
Leaves crowded at apex of stem **falcata,** Sond.
Stem leafy below the apex **versicolor,** L.*
Stem very short **glabra,** Thunb. var. **pusilla.**
Petals not as above.
Leaflets narrow-linear, 6—12 ls. long **polyphylla,** Jacq.*
Leaflets linear-cuneate, oblong-cuneate, or obovate-cuneate.
Leaves sessile or very shortly petiolate.
Stem and branches elongate; leaflets oblong-cuneate .. **hirta,** L.
Stem and branches short, tufted; leaflets obovate-cuneate **brevicaulis,** Sond.
Leaves petiolate.
Hairs on petioles and peduncles reflexed **obtusa,** Jacq.*
Hairs on petioles and peduncles not reflexed.
Stem well-developed; petals usually deep bright-pink **glabra,** Thunb.*
Stem very short; petals usually white **minuta,** Thunb.
Leaflets subrotund.
Petals yellow .. **luteola,** Jacq.
Petals not yellow.
Water-plant **natans,** L.f.
Land-plants.
Hairs glandular; fls. small in the genus **punctata,** L.f.*
Hairs not glandular; fls. medium or large.
Leaves pubescent all over; corolla-tube pubescent **lanata,** L.f.*
Leaves glabrous or ciliate.
Stem well-developed, branched; shade-loving **incarnata,** L.*
Stem very short; sun-loving.
Leaflets petiolulate, with long and distant cilia **denticulata,** W. Dod.*
Leaflets not as above.
Corolla funnel-shaped.
Corolla pale mauve, less than 1 in. long **commutata,** Sond.*
Corolla usually rose-pink, 1 in. or more long **variabilis,** Lindl.*
Corolla salver-shaped **purpurea,** Thunb.*
Leaflets 4—19.
Petals white; leaflets pubescent **tomentosa,** L.
Petals pink; leaflets glabrous **pentaphylla,** Sims.*
Petals yellow; leaflets glabrous.
Leaflets oblong-linear or linear, 1—3 ls. wide **flava,** L.
Leaflets oblong or obovate, 4—6 ls. wide **lupinifolia,** Jacq.
Peduncles more than 1-fld.
Petals yellow.
Rootstock bulbous; stem not creeping.
Glabrous.
Petioles terete **cernua,** Thunb.*
Petioles compressed .. **compressa,** Thunb.
Pubescent **sericea,** L.f.
Rootstock not bulbous; stem creeping **corniculata,** L.*
Petals pink or white.
Leaves pubescent all over .. **lanata,** L.f.
Leaves glabrous.
Stem well-developed; leaflets usually livid beneath **livida,** Jacq.*
Stem very short; leaflets not livid beneath **caprina,** L.*

Bolus Herbarium,
University of Cape Town. L. BOLUS.

Explanation of Plate One: South African Geraniaceae.
I. LEAF.—Figures 1-9, Pelargonium; 10, Geranium; 11, Sarcocaulon; 12-16, Oxalis.
II. FLOWER.—Figure 1, Oxalis; 2, Sarcocaulon; 3, Monsonia; 4, Geranium; 5, Erodium; 6, 7, Pelargonium.
III. ANDROECIUM.—Figure 1, Oxalis; 2, Sarcocaulon; 3. Monsonia; 4, 5, Pelargonium; 6, Geranium; 7, Erodium.
IV. GYNAECEUM.—Figure 1, Oxalis; 2, Sarcocaulon; 3. Monsonia; 4, Pelargonium; 5, Geranium; 6, Erodium.
V. FRUIT.—Figure 1, Oxalis; 2, Geranium; 3, Erodium; 4, Pelargonium.
VI. UNDERGROUND RESTING-STOCKS.—Figure 1, tuber of Pelargonium § Hoarea; 2, do., the tunics removed; 3, bulb and bulbils of Oxalis.

THE CULTIVATION OF GERANIACEAE.

THE Order as represented in South Africa includes :—

Monsonia, embracing annual and herbaceous perennial plants ;

Sarcocaulon, a genus of fleshy, spiny, rigid dwarf shrubs, about 12 inches high and as much through ;

Geranium, several species of biennials ;

Erodium, mostly annuals ;

Pelargonium, containing the largest number of species, which vary considerably in their form and habits. A few annuals, a large number of herbaceous perennials, tufted perennials, succulent and fleshy shrubs, woody shrubs, and the trailing *P. peltatum* ; and

Oxalis, which are tuberous rooted plants second only in number of species to the Pelargoniums, and includes the only aquatic plant of the Order.

Their requirements under cultivation vary as largely as their form. Their utility for garden decoration is greatest in the Pelargonium and Oxalis. The Geraniums of Gardens, Show, Fancy and other Hybrid Pelargoniums do not come within the scope of this article. Although general favourites in gardens of the present day they passed the zenith of their popularity some 60 or 70 years ago when they were surpassed in popularity and interest only by the rose. At that time a Society was in existence to look after their welfare, much on the lines of present Carnation and Sweet Pea societies, with conferences, shows, etc., to extend and increase their popularity and cultivation.

The native species throughout the Order are readily raised from seed, but with various types of perennials three or four years are required to reach the flowering stage. The perennial Monsonia and shrubby Pelargoniums may be increased from root-cuttings, inserted in sandy loam, with the correct tip inserted just below the surface of the soil. A length of 1½ to 2 inches is suitable, and February and March the best months for the work. Good examples of the types of roots required are found in the *Monsonia speciosa* of the Stellenbosch District, and in *Pelargonium cucullatum*, the large leaved "Geranium" so common throughout the Peninsula. This mode of propagation with hybrid Pelargoniums often results in a flower differing in colour and form to the present plant, but it is anticipated this variation will not take place when dealing with true species, so that no "royal road" to "infinite variety" may be expected from its practice.

The easiest and general method of increase adopted with the shrubby species, of whatever nature, throughout the Order, including Sarcocaulons, is by cuttings of the usual kind inserted in sandy loam during February and March, and stood in a shady spot until rooted. Excessive moisture in the soil before roots are emitted is a fruitful source of loss.

The *Monsonia speciosa*, a herbaceous perennial, is partial to a well-drained sandy loam, and when thoroughly established is most striking in full flower. Its maroon and port-wine-stained white flowers are over two inches across when fully open, and delight, and open only, in full sun. It dislikes removal when in growth, but a small percentage can usually be secured. The compact tuft of feathery foliage when topped with flowers is seen to advantage on the flat or a gentle slope. As with all our sun-loving plants a position must be allotted them on the south side of a path or other point from which they will be viewed but added interest is given by a back view owing to the differing colours on the outside of the petals. *Monsonia ovata* is a distinct hairy little plant for the rockery.

Of the Sarcocaulons, which are typical Karroo plants, *S. Patersoni*. *S. L'Heretieri*, and *S. Burmanni* respond kindly to cultivation. A dry situation on a rockery with a firm loamy soil will suit them. An occasional watering during dry weather will enable them to produce their tissue-paper flowers freely during the height of summer.

The true Geraniums are soft herbaceous plants delighting in the virgin soil among bush and in open spaces in the woodland. *G. incanum* is common at Kirstenbosch in two colour forms, white and rosy mauve. It makes a diffuse mass on the ground, and is charming in a shady recess among rocks. Of its longevity I am uncertain; it may be more perennial than biennial, but certainly not more than three or four years.

The Erodiums of my acquaintance are more or less weedy subjects of no horticultural value.

In the Pelargoniums we have a large percentage of choice and showy plants in flower and foliage that will occupy prominent positions in the component parts of comprehensive gardens of the future. The alpine-like *P. violarium*, *P. trifoliatum*, *P. oxalidifolium*, *P. capillare*, etc., are unsurpassed in mats or tufts in front of a rockery. Higher up *P. echinatum* and *P. fulgidum* will stand out distinct and attractive, while *P. tetragonum* will add interest with its distinct form and gaping flowers. For a bold edging *P. ovale* stands out in flower and foliage, and *P. tomentosum* with its downy foliage and low spreading habit makes a ground-work for the scented-leaved *P. radula*, *P. quercifolium*, etc., further back in the border or bed. In the wild-garden masses of *P. betulinum*, *P. myrrhifolium*, *P. saniculaefolium*, etc., will be attractive throughout their season, as well as *P. peltatum* scrambling through bushes, or down sunny banks.

Last, but least only in stature, are the Oxalis. Some are indeed true harbingers of the rainy season or "Cape Spring." Many stud and carpet the ground throughout the winter, and others carry on the display to the end of the year. All, of horticultural value, are deciduous bulbous plants, partial to moisture, a soil rich in humus, and to a varying amount of shade. *O. natans* is a true aquatic during its growth in winter, but withstands drying out in summer. *O. incarnata* demands abundant shade at all times, and thrives best in virgin leafmould.

Many species increase freely at the root, and by seeds. Several species have one or two colour forms, and others have perfect double flowers. In *O. hirta* the doubling in several colour shades is very effective, and call to mind the rosettes of the Double Primroses of old.

An essential point to grip in the cultivation of this Order, as indeed it is in all the plants of this vast and varied sub-continent, is whether they are summer or winter plants. Broadly, all can be divided into two classes, Western and South-Western as winter and spring flowering plants, and Northern and Eastern as summer flowering plants. The winter and spring flowering need, and are benefitted only occasionally by artificial watering. The summer flowering will constantly require watering to secure a maximum display.

Kirstenbosch,
April 5th, 1922.

J. W. MATHEWS.

MEDICINAL AND AROMATIC PLANTS IN SOUTH AFRICA.

SOUTH Africa yields certain important drugs in large quantities, the chief of these being Aloes and Buchu, the products being collected mainly from the plants growing wild.

Aloes is the evaporated expressed juice of the leaves of *Aloe ferox* and occasionally other species and is chiefly prepared in the Mossel Bay and Herbertsdale districts. In 1920 no less than 796,515 lbs. of Cape Aloes were exported, the value being £15,607. It may be noted that Cape Aloes fetches a much lower price in the London market than Socotrine and Barbadoes Aloes, this being probably due to the crude method of evaporation employed, an improvement in which would certainly raise the value of the product.

No attempt has been made to cultivate Aloes for drug production. In the case of Buchu, however, the high prices of recent years and the diminution of the wild supply has aroused great interest in its possibilities as a paying crop.

Buchu Folia of the British, American and other pharmacopoeias is the dried leaf of *Barosma betulina, B. crenulata* and *B. serratifolia.* These are shrubby plants of the family Rutaceae with a strong aromatic odour due to the high content of essential oil. They occur wild mainly in the south-west of the Cape Province. *B. betulina,* which is collected under licence chiefly in the Forest Reserves of the Cedarbergen, is the most valuable species, the leaf-oil containing diosphenol which is lacking in the other species. In 1920 a total weight of 139,149 lbs. was exported, to a value of £67,243. The price in 1921 was much lower, but even so a good Buchu plantation was highly profitable. The methods of cultivation have been studied at the National Botanic Gardens, Kirstenbosch, where a successful plantation is to be seen, and where instructions can be obtained on application. Seed is sold by the Forest Department, though the supply is limited and the percentage germination is always low. Once established, however, a Buchu plantation will yield an increasing weight of leaf annually for many years with comparatively little attention. Success can probably only be obtained in the south-western and coastal districts of the Cape Province.

There are various other medicinal plants, not native to South Africa but fully naturalised in certain localities, which might well repay systematic cultivation and collection. *Datura Stramonium* (stinkblaar), a frequent weed of cultivation, yields leaves and seeds for which a ready sale is to be obtained in Britain and America, chiefly as a constituent of certain patent medicines. As a source of alkaloids, however, it is now replaced by *Datura Metel, D. fastuosa* var. *alba* and *Hyoscyamus muticus*: the two first of which could certainly be grown in South Africa, though the Hyoscyamus has not so far proved successful. *Digitalis purpurea* also grows with great luxuriance in some parts of the Union and Rhodesia and so does the Castor Oil, of increasing value as a lubricant as well as being indispensable in medicine. Another interesting product is Liquorice (*Glycyrrhiza glabra*) which has now thoroughly established itself at Oudtshoorn, De Aar and elsewhere, and of which manufacturing chemists and confectioners use considerable quantities.

In addition to the wild and naturalised medicinal plants of South Africa it is probable that other important drugs might be successfully cultivated in one part or another of the Union. The National Botanic Gardens is carrying out experiments on introducing and cultivating certain of these, and information as to methods of cultivation and prospects is gradually being acquired and will be available to anyone interested. It is clear that it will be possible in many cases to supply the local demand for drugs: but it is equally clear that the business of growing medicinal and aromatic plants is at present highly speculative, and that the ultimate success of any such undertaking must depend on the ability of the South African product to compete with others in the European and American markets.

A word must also be said about the indigenous South African plants used by the natives and Europeans as poisons and remedies, Many of these such as "bitterblaar" (*Brachylaena elliptica*), "kankerbos" (*Sutherlandia frutescens*), "zandolien" (*Dodonea Thunbergiana*), and "kruidje-roer-mij-niet" (*Melianthus niger*), are highly esteemed for home-made medicaments. As far back as 1847 Dr. Pappe published a list of 70 plants used as remedies by the colonists, with their properties and modes of use. The majority of these plants are still unrecognised officially, though it is probable that some at least would be of service if tested scientifically and regularly obtainable and prescribed. In this connection

the work initiated by Professor Gunn of the Department of Pharmacology in the University of Cape Town must be mentioned. Work on the chemistry of certain native plants poisonous to stock is also being carried out by Professor Rindl of Grey University College in connection with the Union Government Department of Agriculture, and may well yield results of medical value.

The somewhat cognate subject of the possibility of producing essential oils in South Africa is also being studied at Kirstenbosch. It is clear that the climate of the south-west and coastal districts of the Cape Province is admirably suited for the production of an abundant yield of high-quality oils of various kinds. One of the most extensively used oils, Oil of Geranium, is derived from plants originally native to South Africa, viz., *Pelargonium Radula, P. odoratissimum, P. graveolens* and numerous other species and hybrids. The opportunity of establishing this industry in its natural home in South Africa was missed, and the market relies on the extensive supplies now produced mainly in the Mediterranean Region with its "Cape" climate.

The establishment of essential oil cultures in South Africa would have to compete with the large-scale productions of Europe, America and Japan. In many cases this would be impossible owing to the limited demand and to the industrious and efficient labour available in some of those countries. In other cases, however, the prospects are bright: South Africa herself consumes a fair amount of essential oils in confectionery, etc. (in 1913 essential and perfumed oils to the value of £23,107 were imported), and for certain oils there is an almost unlimited market overseas.

It should be possible, given a moderate capital and some knowledge and patience, to establish payable cultures of peppermint, lavender and pelargonium in the south-western and coastal districts of the Cape. An essential oil distillery would be a necessary part of any such enterprise. Numerous other sidelines might prove profitable in such an establishment by keeping the stills employed. If capably managed there is little doubt that such an industry would be able largely to supply the South African trade and to find a place in the European market also. Here again, however, as in the case of drugs, it is necessary to emphasise the erratic course of prices at the present day: and anyone thinking of taking up the cultivation of oils would be well advised to have some other "bread-and-butter" crop as a stand-by for the first few years.

The following is a list of the chief medicinal and aromatic plants at present in cultivation at Kirstenbosch. In the majority of cases we can supply living material for experimental cultivation in South Africa to the members of the Botanical Society on the understanding that a report as to the success or otherwise of the culture is sent in later on. Advice as to the most promising methods of growing these plants will also be supplied on request, though their cultivation in South Africa is still in the experimental stage.

Aconite: Aconitum napellus.
Adenandra spp.
Agathosma spp.
Aloes: Aloe ferox.
Aloe spp.
Artemisia afra.
Barosma spp.
Belladonna: Atropa Belladonna.
Bitterblaar: Brachylaena elliptica.
Blisterbush: Peucedanum Galbanum.
Buchu: Barosma betulina (round).
B. crenulata (oval).
B. serratifolia (long).
Bush Teas: Cyclopia Vogelii.
C. genistoides.
Leyssera gnaphalioides.
Aspalathus corymbosa.
A. spp.
Camphor: Cinnamomum camphora
Castor Oil: Ricinus communis.
Chamomile: Anthemis nobilis.
Colchicum autumnale.
Coleonema spp.
Datura Metel.
Empleurum sp.
Eucalyptus citriodora.
E Smithii.
E. spp.
Fennel: Foeniculum officinale.
Foxglove: Digitalis purpurea.
Geranium Oil: Pelargonium capitatum.
R. odoratissimum.
P. Radula.
Kankerbos: Sutherlandia frutescens.
Kruidje-roer-mij-niet: Melianthus niger.
Lavender: Lavendula vera.
Lavandula sp.
Liquorice: Glycyrrhiza glabra.
Mentha spp.
Otto Rose: Rosa damascena (2 varieties).
Pelargonium spp.
Pennyroyal: Mentha Pulegium.
Peppermint: Mentha piperita (black variety).
Poison bush: Acccanthera spectabilis.
Rosemary: Rosmarinus officinalis.
Scilla spp.
Spearmint: Mentha viridis.
Squills: Urginea maritima.
Stramonium: Datura Stramonium.
Tansy: Tanacetum vulgare.
Urginea spp.
Valerian: Valeriana officinalis.
Verbena Oil: Lippia citriodora.
Wormwood: Artemisia Absinthium.
Zandolien: Dodonaea Thunbergiana.

The collections of these and other economic plants at Kirstenbosch can be inspected on application to a member of the staff. At present they are specially instructive to students of pharmacy, as well as being of more than ordinary interest to the general public.

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R. H. COMPTON.

Kirstenbosch,
April, 1922.

CATERPILLARS AT KIRSTENBOSCH.

THE fundamental principles of caterpillar-life are, as "Eha" says in his delightful book "A Naturalist on the Prowl," that a caterpillar is a little creature ordained to be eaten, and at the same time to eat; and that the simplest way not to be eaten is not to be found. He then proceeds to describe some of the devices adopted by caterpillars by means of which a few, say one per cent., may escape the many and various perils that beset them, and arrive at maturity, lest the race become extinct.

* * *

Union is Strength.

By far the most successful expedient that has been tried, "Eha" says, is loathesomeness; there are some caterpillars that no decent bird would touch. But what a bird loathes, an ichneumon larva may love, and no caterpillar can carry two flavours at once. Now at Kirstenbosch it has always seemed to me that the ingenuity of the social caterpillar should be placed very high. It is no doubt that of a common moth,* is green and small, the larger ones being about an inch long, and has a bullet-head. The parties consist of any number up to forty and, if they are disturbed, they hurry oft to the sheltered spots of their retreat, or let themselves down by a silken thread. As one would expect, the tips of the branches, where the leaves are youngest, are chosen by the mother for her eggs; and the only plants she favours as far as my observations go are the lepelhout† and the pendoorn,‡ both members of the Family *Celastraceae*. When, therefore, the familiar white covering of web is at the end of a branch one may reasonably hope to find a party of infants. But it is necessary to keep an open mind, for the gathering usually comprises caterpillars of all sizes. A small break in the web will disclose the whole scheme—the caterpillars themselves, scurrying off; and the leaves, providing the necessary provender, and at the same time serving as a protection, controlled by the finely spun web which forms a tent over all. Now if some of the most likely caterpillar-enemies are enumerated, such as birds, wolf-spiders, wasps, ichneumons, and ants, one would be inclined to think this little creature had managed to baffle them all. But of course this is a most unlikely state of things, for it would never do for anyone, much less a caterpillar, to have all its own way. Perhaps a study of the pupal stage will reveal some weak places. It is almost as easy to see where these picnics have been as to see where they are actually being carried on, for, although at first only the green tissues on the inner surface are eaten, later these are eaten right through, and only the dry "bones" of the skeleton are left. As they retreat their shelters may reach a length of seven or eight inches, and, when an adjacent branch is to be converted into a safe dining-room, there is a fairly broad bridge of silk through which the diners pass from the old tent to the new.

* Probably one of the Family *Tortricidae*, so called because they roll or contort leaves and branches. The caterpillars of some other members of this Family live actually in their food, which may be fruit (e.g. the notorious Codling Moth) or herbs, or galls.

† *Elaeodendron Kraussianum.* ‡ *Gymnosporia buxifolia.*

Another safe method is the one adopted by the leaf-mining caterpillars, although the herbivores, who may eat them up, leaf and all, must be formidable enemies. Between the upper and lower skin of a leaf they munch, leaving a white trail in their wake—at first a very faint one but gradually becoming wider. The line winds like a river, and when too stout a vein is encountered, it doubles back, until, oh joy! the caterpillar has been strong enough to cross the midrib, and get over to pastures new, usually, however, towards the apex of the leaf where the midrib is weakest. Sometimes there are several caterpillars on the same leaf, and one wonders what happens when one long-lost brother mines into another long-lost brother! These caterpillars probably belong to the same Family (*Tineidae*) as the clothes-moth, and are minute even when full-grown. The moth itself must be small indeed, if one bears in mind the usual relative sizes of the body of the perfect insect and its caterpillar. Early in the Spring they are to be found on the sow-thistle (*Sonchus oleraceus*), and later in the year on black nightshade (*Solanum nigrum*), and *Knowltonia*. Similar trails are also frequently seen on the waa' boom (*Protea grandiflora*) and on *Protea incompta* but these require investigation, for they may belong to the mining grub of some two-winged fly.

Leaf Miners.

* * *

The large brown "woolly-bears"* practise the gentle method. A lizard is waiting, and the caterpillar with stately gait and every hair on its body fluffed out walks past him. The lizard gives a grab—and gets the caterpillar?—Oh no! Only a mouthful of stinging hairs. The moralist would point to the efficacy of a gentle answer, for the lizard, realising how foolish he has been, will remember next time, and will leave this caterpillar severely alone. The ichneumon, however, is gentle too, but with the peculiar fiendish gentleness of a parasite, and against her attacks stinging hairs are of no avail. For she can bide her time, and when her victim is quietly dozing she will seize her opportunity. The long and slender ovipositor is brought into play, and her eggs are neatly placed, between the hairs, on the back of the caterpillar, which by and by succumbs to the voracity of the hatched ichnemons who bore into its body.

The "Soft Answer."

* * *

But the truly gentle method is that of those caterpillars who assume the garment of invisibility, and whose main idea is, apparently, to remove all temptation from the eyes of their aggressors. If they are discovered they tuck in their heads and coil round, hoping for the best. In this attitude as likely as not they will roll off the leaf, and get lost in the brushwood below. It is these which exhibit the most interesting cases of protective resemblance—a phenomenon which is very common among caterpillars. Professor Poulton associates its frequent occurrence with the peculiarly defenceless condition of these young animals. "The body is a tube which contains fluid under pressure; a slight wound entails great loss of blood, while a moderate injury must prove fatal." The simplest instances are found among the numerous leaf-green caterpillars which match perfectly the shade of the plant on which they are feeding. If the caterpillar is a large one the green will be broken up by some pattern, which breaking up tends to resemble the lights and shadows among the foliage. Moreover it will frequently feed on the upper side of the leaf, which is the outer side from the point of view of the bird hopping about among the twigs. Sometimes the texture of the leaf is imitated or even some detail of the shape, as in some caterpillars I saw feeding on the leaves of a *Kalanchoe*. These leaves were scalloped-edged and bordered with a reddish tinge, and the caterpillars were harmoniously reddish, and had a "scalloped effect" on their backs, thus admirably resembling the leaf-margin itself.

The Garment of Invisibility.

Perhaps the most successful of the gentle ones are the "loopers" or "humpy-backs," belonging to the geometer moths (*Geometridae*), which not only in colour but also in form so strikingly resemble the twigs of their food-plant. They are of a much more delicate build than most caterpillars, and instead of having the usual five pairs of prolegs (the back stumpy feet as opposed to the six more slender feet near the head-end which are the only ones retained by the perfect insect) have only the two hinder pairs, or at least only these two pairs are functional, viz., the "claspers" and the pair next to them. These caterpillars are able to stretch themselves out from a branch, at the same angle as that of the twigs, and in that strained attitude, supported by a thin thread of silk, exactly resemble their surroundings.

* * *

Also to be reckoned among the truly gentle methods of defence is the "masking" of the "bag-worms" which ingeniously construct for themselves "bags" or "masks" of the various oddments which surround them, or probably in some cases of the bits they actually cut off from the plant they require. Professor Thomson tells us that masking is one of the most interesting ways in which animals strengthen their hold on life, and that it is best illustrated on the sea-shore where there is a keen struggle for existence and much opportunity for device. At Kirstenbosch one "masker" chooses pieces of a slender-stemmed *Elegia* or *Dovea* (*Restiaceae* or thatching-riet Family). The pieces appear to be a little longer than the caterpillar itself, for the hinder end of the body is invisible, and they are joined together without overlapping to form a palisade. When at rest the mask looks exactly like the small pieces of restiaceous stem that collect in tiny hollows after rain, and when in motion the black furry head reminds one of the withered flowers of these very plants. Another masker uses tiny bits of leaf and stem from the young shoots of a *Buddleia* and succeeds in looking remarkably like a bit of twig. "Bag-worms" belong to a Family of moths known as the *Psychidae*. Dr. Gilchrist writes that these apparently animated bundles of sticks or fragments are looked upon with suspicion

Maskers or Bag-Worms.

* Probably belonging to the eggar moths.

by some farmers in South Africa, who believe that they are not without a supernatural import. In some cases the females have no wings nor legs, and never leave their masks, but deposit their eggs inside their former pupa-skin where they hatch out, and, perhaps, make their first meal on the body of the parent. The males are said to live only a few days.

Among the "maskers" should be included the clothes-moth which "Eha" considers may now be ranked among our domestic animals. Having digested the wool (for vegetable fabrics are not to its taste) it has mined out of our garments it uses the pellets from its intestines to make itself a dress which it enlarges by means of gussets as necessity requires. These moths belong to the same Family (*Tineidae*) as the leaf-miners. Yet another "masker" may be found, usually on inside-walls, in a tube of silk coated with sand and lime, and feeding probably on minute fungoid growths.

* * *

Nastiness.

Certain butterflies rely on pure nastiness as a method of protection making no attempt whatever at defence, and are distasteful in their infancy and youth as well as in their adult stage. Two examples may be cited as occurring frequently at Kirstenbosch. *Acraea Horta*, a black and terra-cotta butterfly with the apical portion of the fore-wings transparent, and *Danais Chrysippus*, brownish-red with black and white blotches on the tips of the fore-wings. The former may be found all the year round but the latter I have noted only in the autumn and the winter. *Acraea* caterpillars have strong black branched spines and are to be found usually in family parties on kersanhout or wild peach (*Kiggelaria africana*). *Danais* feeds on the *Stapelias* and other members of the same Family. It is bluish-grey, transversely barred with yellow and streaked with black, and has three pairs of flexible filaments springing from the back, the front pair being the longest. Both caterpillars are no doubt parasitised to a large extent by ichneumons and wasps.

* * *

Bluff.

Some caterpillars combine two or more methods of defence. Besides being distasteful they assume most terrifying attitudes. *Papilio demodocus* (the large black and sulphur-yellow butterfly) affords perhaps the best example at Kirstenbosch. Feeding on the blister-bush (*Peucedanum Galbanum*) it is a conspicuous object of many colours, of which yellow, brownish-red, and dark purple seem to dominate. The young forms have short spines. When it is hurt or irritated head and chest are thrown back in a most alarming manner, the legs looking like fangs, and a Y-shaped tentacle is protruded and brandished, emitting a brownish fluid with a pungent smell. The arum-lily hawk moth besides waving its sham sting and being generally terrific harmonises in colour with its food-plant, and thus by a combination of advantageous qualities manages to baffle most of its enemies except the dreaded parasites who are not to be deceived by all this fine show of courage.

* * *

Lovers of Darkness.

Among the caterpillars who take refuge in "the trailing garments of the night" are the owlet-moths (*Noctuidae*). They feed "on or near the surface of the ground, destroying the roots and lower parts of the stems of vegetation," and are for this reason known as "cut-worms" or "mest-wormen." During the day they lie hidden in some retreat.

* * *

These are a few of the many caterpillars to be found at Kirstenbosch, all awaiting careful observation, and I think I cannot do better than quote Mr. Skaife's appeal at the end of his admirable chapter on butterflies and moths ("Animal Life in South Africa"). "In the study of the life-histories of our native moths, boys and girls have a wide field of very useful work open to them. Let them collect living caterpillars and rear them to the adult stage. They should take note as to the appearance of the caterpillars, when and where found, the nature of the food, when they change into chrysalids, and when the adults emerge, etc. The adults as they emerge can be killed and mounted and in this way perfect specimens will be obtained. These mounted specimens can be sent to the museum together with the notes on them, and in this way much valuable information will be added to our present meagre information about our moths."

L. Bolus.

May, 1922.

KIRSTENBOSCH THE BEAUTIFUL.

THE original sketches prepared for this issue unfortunately met with an accident, and at the last moment it became necessary to work up others hastily; this by way of apology for the imperfect nature of the drawings. But really, no effort of my pen or brush can at all do justice to the sublime grandeur of Kirstenbosch and the orderly beauty of its Gardens.

It would be difficult to say what it was I expected to see. My only conceptions of the place were drawn from a sort of elevation-plan and I certainly never contemplated carefully laid-out grounds and green sward as fresh as any that ever grew in the Emerald Isle. In fact, so green was it that I half expected to find the trefoil, that national emblem of Ireland, but subsequent enquiries elicited the fact that none had even been seen at Kirstenbosch. Well, of course not, the Shamrock grows only in Ireland.

Did I call the scenery sublime? It is all that and more. It is a gem set in the golden crown of the Cape Peninsula, and yet an artist told me a few days ago that it did not appeal to him as a sketching ground.

He had better change his profession and take to boot-making; that would, at all events, produce some lasting impression upon his soul.

Frankly, I was charmed with the scenery. I wanted to sit down and study it in detail, but I had only about four hours in which to secure six sketches of a very impressionistic character. Four hours, when one was surrounded with such a wealth of interesting detail! One could have spent the whole day over one subject and have cheerfully returned to complete it on the next.

As you enter the gate you are confronted with the towering buttresses of Table Mountain, in the deep-carved gullies and ravines of which indigenous trees cluster in dense masses. In the foregound are well-kept paths, and the refreshing green of the lawn, with the glint of sunlight sparkling on the Lily Pond, whose surface mirrors the grim form of the sentinel standing eternally at the gateway of the sub-continent. It is a broken reflection, however, for the surface of the water is partially covered with lilies.

On your left the ground rises in a gentle swell, and on the right the cool shadows of the trees tempt one to explore. In the middle distance the grass terminates in a terrace upon which stands the most extraordinary sun-dial I have ever seen. It is a great weathered block of sandstone, flat on the top, with the usual index for casting the shadow.

Then from the terrace rises the Aloe Kopie. One thinks of the monstrosities of rockeries that grace some gardens, but this is the real thing. The Aloes are most interesting and represented by many various species. Behind the Rockery, pine forest clothes the talus slopes, giving an impression of stateliness, while towering over all the mighty bulk of the "Castle Rock" suggests mediæval romances, and above stretches the deep blue of the South African skies.

From the Aloes one obtains a panoramic view across the Cape Flats, limited on the one side by the slopes of the Wynberg Hill, and on the other by the dense masses of trees, rising to a corresponding height. The balance of the picture is perfect.

The sketches give a most inadequate idea of the distances, owing to their small size and the impossibility of suggesting details unless in much larger drawings, but the eye travels across a wide vista of trees and across the Flats to the ranges of mountains tier behind tier, fading away till they are no longer definable and are lost in the haze of the autumn afternoon.

I found the Bath a most interesting subject. It is an egg-shaped structure of red Batavian tiles or bricks, with a recess on one side in which a flight of five steps leads to the bottom, which is flagged with tiles. On the left of the Bath rises a bank of ferns, above which is a path, and the background is made up of hillside, planted with Cycads and colonised by Silver Trees, behind which one catches a glimpse of the escarpments of the mountain.

On the right tall Ilex trees cast a deep shade over the Bath and help to ensure privacy. The Bath is situated at the head of a romantic dell, which reminds one more of European scenery than that of South Africa.

But the Dell itself, well—in a word—it is lovely, and my only regret was that time forbade a careful study of its delicate details of ferns and rock work, and the sketch is the merest impressionistic note of this most favoured of all spots in the Kirstenbosch Gardens. At a future date it is hoped to give the public more detailed drawings.

On the list of subjects given me by the Director, was Van Riebeek's Hedge. Mr. Mathews had kindly pointed out the locality to me earlier in the day but I could find no trace of anything that suggested a hedge, until, for the second time, he pointed out two great clumps of bushes about ten feet high, the remnants of the hedge that at one time circumscribed the colony and terminated in Kirstenbosch. The remainder disappeared somewhere amidst the silver leaf trees, and I am afraid the reader will have some difficulty in identifying the sketch as "Van Riebeek's Hedge."

The cab was now waiting for me and I came away more than pleased with the results of my afternoon's work, but longing for the opportunity to make a careful study of the scenery.

The educational value of Kirstenbosch Botanical Gardens must be very great, not only from the botanical but from the artistic view-point, and to the worn toiler it must be a haven of rest.

After all, there is nothing so soothing, amidst all the turmoil and the deepening chaos of the present evil days, than a day spent with Nature. It matters not what your mood may be, you will find her responsive. Amidst the pines you will hear her whisper to you in low tones, words of consolation and of peace. Not a jarring sound mars the stillness of the scene save the far-off screech of the locomotives, too far away to be heeded. But there amidst all the discordant clamour attending the affairs of men, our minds turn to the peaceful Kirstenbosch, for here indeed is rest, and here can be heard the silences and the voices of God.

Lakeside, May, 1922. G. J. Porte.

"Nearer the mountain than Bishopscourt is Kirstenbosch, a Company's military outpost from the earliest days to the British occupation. At that time the lower portion of the land was granted to the Colonial Secretary, Mr. Alexander, and the upper portion to Colonel Christopher Bird. On the ground belonging to the latter is an exquisite little sunken bath, ovoid, lined with tiny Batavian bricks and sheltered from the sun by lofty trees. This was the swimming bath of the daughters of the house when it was owned by the Eksteens in the early days of last century, and slave girls sat in a circle on the shady bank above to keep away intruders. To-day I like to think that when night falls on Kirstenbosch, Pan and the dryads creep from the leafy mountain glens and bathe in the cool moon-lit water. The Kirstenbosch homesteads are in ruins, but around the ruins and in the deep mountain ravines the Botanic Gardens of South Africa will guard for future ages the trees and flowers which are the glory of the whole earth and not of one province of the Union only."

Miss Dorothea Fairbridge,
Historic Houses of South Africa, p. 70, 1922.



G. J. Porte del.

Sketches in Kirstenbosch.

PLATE TWO.

AMERICAN OPINIONS OF KIRSTENBOSCH.

DURING the last two years Kirstenbosch has been visited by a number of botanists from overseas, and in particular we have had the great pleasure of welcoming four distinguished botanists from the United States. These visitors have written letters from which it is interesting to quote, as a sample of the way in which the work and aims of the National Botanic Gardens appeal to those who bring a fresh and at the same time a trained vision to bear on Kirstenbosch.

Dr. Shantz.

Dr. H. L. Shantz, Botanist in the Bureau of Plant Industry of the United States Department of Agriculture, was a member of the Smithsonian African Expedition and visited Kirstenbosch in August, 1920. In the report of the Smithsonian Explorations for 1920 we read: "The vegetation of the Cape region has long been known to European botanists, and has received more attention than that of any other portion of Africa. It is difficult to imagine a region which has so many striking features. The wealth of Proteas and Ericas alone would make this region unique. Lilies of various and beautiful types, Iridaceae, Amaryllidaceae, and Orchidaceae, each represented by many genera and species, the Arum Lily or calla, which occurs everywhere in wet soil, and Pelargoniums, which here cover the mountain sides, make of this Cape region a natural botanic garden, so rich and varied that any botanist will here find plants of absorbing interest. At Kirstenbosch there has been established the National Botanic Gardens, now under the direction of Professor R. H. Compton. If the well-laid plans are fully carried out it will be possible to find here all of the more interesting indigenous plants of South Africa, and to this garden will come botanists, horticulturists, and agriculturists interested in South African plants. American botanists would be proud if we had anywhere in our country a garden to compare with it." Dr. Shantz wrote me a letter, dated 12th October, 1921, after his return to Washington, in which he says: "Looking back, the time seems entirely too short in every place, and especially in your wonderful garden there at Kirstenbosch. I feel sure that what you are doing there is exactly the right thing, and that to build up a garden as you are doing of endemic plants is far better than to attempt the usual garden made up largely of exotics. I shall never forget the two days I spent with you, and I wish very much we had such a place in this country and a similar collection."

* * *

Prof. McLean.

On October 30th, 1920, the Mountain Club held one of its Natural History Rambles at Kirstenbosch, and among the guests were Professor Forman T. McLean, head of the Department of Botany in the University of the Philippines, and Mrs. McLean. Writing to Mr. H. C. F. Exner from Los Banos in June, 1921, Professor McLean says: "None of my very pleasant subsequent experiences has in any way dimmed the pleasant memory of the day that I enjoyed the hospitality of the South African Mountain Club. Nothing I saw in Australia could in any way compare with Kirstenbosch, either in its conception or in the broad way in which it is being developed. To me your National Botanic Garden is as unique as is your native wild-flower flora. South Africa, which has furnished the world with many of its most beautiful flowers and ornamentals, has both the responsibility and opportunity to assemble and preserve them under natural conditions. No other country can hope to rival you in your garden at Kirstenbosch.

"Of the Australian States, West Australia has the richest wild-flower flora, but the Melbourne Botanic Garden is the only one which has seriously undertaken to assemble the native flowers. It has a New Zealand and an Australian border, but these are not extensive enough to display the native flowers advantageously.

"The Australian Commonwealth is surely rich in resources, and has not spared expense in beautifying its cities. Consequently the botanic gardens have developed into wonderful parks, the finest of which are those of Sydney and Melbourne, both of which were laid out by Mr. Guilfoyle, who was a landscape artist of exceptional ability, judging from his results. Both are beautiful assemblages of the plants of the world, but neither is Australian in the sense that Kirstenbosch is South African."

* * *

Dr. Cannon.

Dr. W. A. Cannon of the Department of Botanical Research in the Carnegie Institution of Washington, who is an authority on the physiology of desert plants, spent some months in the latter half of 1921 in South Africa, where he travelled widely. Staying some weeks at Matjesfontein he was able to see the Whitehill Karroo Garden: and he also visited Kirstenbosch. Writing to me shortly before his departure from Cape Town he expressed himself as follows:—

"I was much interested in seeing what you are getting done in the way of assembling South African plants in such manner that they will be accessible to all who may be desirous of studying them, and, moreover, so that such species as are not abundant in nature may not wholly be exterminated for any reason whatever. At the Karroo Garden you have started a splendid harbour for plants which do well under arid or semi-arid conditions and which would do but indifferently were these conditions greatly changed, and at Kirstenbosch you have a garden of what seems to me wonderful possibilities of assembling a living herbarium, so to speak. When I visited these places, and I refer to the latter more especially, I was struck with the very clear fact that here are what may be called generalised conditions—such as must be acceptable, or even best, for the well-being of plants whose natural habitats are very diverse. This makes it possible for you to grow there a very wide range of plants, such, for example, as occur

in all South Africa. As time goes on the fact that it is a *National* Botanic Garden, in its widest sense, will be, perhaps, its chief glory. I have never seen anywhere a garden better suited, nor nearly so well suited, for the purpose, and I wish you the very best of success in carrying on your work along such lines.

"In the future the lovers of the very wonderful South African flora will no doubt support the Gardens in a way you little dream of. It only needs a judicious bringing of the aims and the needs, etc., of the Gardens to the attention of such appreciative public to accomplish this. At that time (and may it be soon!), you will have a suitable structure to house your herbaria and books and working laboratory. This will make a centre for your activities and will richly repay the public-spirited people who will bring it about. You see I am a "booster" but it is because I am thoroughly interested in your work—I see *something* of its possibilities from a comparative point of view—from what has been done elsewhere."

* * *

Mr. Wilson. Our most recent visitor is a botanist, traveller and plant collector of enormous experience—Mr. E. H. Wilson, Assistant Director of the Arnold Arboretum (Harvard University), who has been touring in South Africa and who sailed from Cape Town on the 7th April, 1922. The day previous to his departure he wrote to me as follows: "As one who has travelled in many lands and has seen most of the botanic gardens of the world, I have grown tired of seeing the same species of plants repeating themselves in cultivation in every botanic garden visited. So it was a great pleasure to me to at last find one botanic garden devoted to the preservation of the local flora and to the cultivation of indigenous plants.

"In this country you have a wonderful variety of lovely and unique plants to draw upon, and I can forsee the day is not very far distant when your garden will rank among the foremost in the world.

"As a lover of plants in general and of trees in particular I thank the broadminded statesmen who caused that 400 acres of land in its wonderful setting to be set aside as a National Botanic Garden, and which now under your able directorship is fast taking shape.

"In thanking you for the courtesy shown to me I should like also to congratulate you and your staff on the excellent progress you are making in building up the botanic garden worthy of the Union of South Africa."

* * *

It is unnecessary to comment at length on these letters, which are highly gratifying to those who love Kirstenbosch and see in it a garden of unique possibilities. All the writers agree in holding the view that we are on the right lines in devoting ourselves to the South African indigenous flora. This is what distinguishes Kirstenbosch from all other Botanic Gardens. Allusion is also made to the beauty of the site and its suitability for its purpose on account of the "generalised conditions" which prevail. The needs for increased public support and for facilities for scientific work are also mentioned. Friends of Kirstenbosch and Whitehill have every reason to be pleased with the considered judgment of our distinguished American visitors, and will pay careful attention to the hints they throw out in so kindly a spirit.

R. H. Compton.

Kirstenbosch,
April, 1922.

LETTERS TO THE EDITOR.

Sir,—Most of your readers are no doubt familiar with the common yellow, silver-banded garden spider (*Argiope clathrata*) which, head downwards and feet in two diverging pairs on each side, keeps guard in the centre of its large orbicular web all through the hot days of summer and autumn. The web itself, different from most other webs in having a conspicuous white zig-zag band which adorns the part immediately below the spider, is hung vertically among low bushes.

It was at 5 p.m. on March 27th, when observing the manner in which the various spiders captured their prey, that we had the good fortune to come upon one of these spiders making the beautiful casket which was to hold her precious legacy. It was carefully hidden among some dry twigs, while green bushes around made a good background, enabling us to follow the different steps more carefully.

She had already spun the lovely little satin egg-sack filled with numerous orange-coloured eggs, and was fixing to it a white, silken, padded lid about the size of a shilling, which projected all round beyond the sack. This done she did not stop to rest, but on she went spinning and weaving round the egg-sack, apparently paying no further attention to the lid beyond choosing points on it to which she could fix her threads. We noticed now that from her spinnerets a single beautiful golden-brown thread was coming which was rhythmically caught first by one of the hindmost feet, then by the other, pulled out into loops, and fastened to the sack. Not once did she look to see what she was doing, but round and round she went until at last the egg-sack was lost to view beneath a wonderful soft golden-brown cloud. Just as suddenly as the spider had changed her silk from silvery-white to golden-brown she changed it again to white, but this time the material was coarser and we found it was waterproof. The structure already was showing the clear outline of a deep cup. In slow measured time she continued, and, as it seemed, at regular intervals glued the silk to the lid.

At seven o'clock we were forced to leave her. The white waterproof sheeting was almost finished, and the silk was leaving her spinnerets far more slowly than before. At twenty minutes to eight we returned, and by the aid of candle-light we found she was just finishing her great work—the green moss-like silk embroidery on the outside being the final touch of this wonderful artist.

Thus does she carefully camouflage the outside after having made all secure and snug within. Her work was done. She seemed to rest upon the nest awhile and then slowly crawled away.

It was most interesting to see how the egg-sack and, later, the finished structure were suspended on silken cords to the dry twigs. There were eight points at regular distances apart on the lid and eight points in the cup-shaped waterproof covering which entirely coincided with them. From these points the spider attaches silken threads to the twigs. That these threads are not so delicate as they look was proved by the fact that we saw, in a bush nearby, nests of last autumn which had resisted last winter's angry winds and rains.—I am, Sir, yours etc.,

GRACE BARTLETT.

* * *

SIR,—Perhaps you will think the following episode of interest to your readers and worthy of publication.

It was a magnificently glorious morning on the fourth of January when we set out fairly early with instructions to observe six birds at Kirstenbosch, "we" being students attending the Botanical Society's summer vacation-course. Entering by the side gate we walked up the path, chatting and laughing, when our attention was arrested by a peculiar screech which seemed to come from somewhere near us. We waited for a few moments, attempting a few guesses as to what it might be, for we never thought that a bird would come so close, or would be so easily discovered, and the noise seemed too loud for that of an insect. The cry was repeated now at shorter intervals, and soon it seemed as if something must be happening. Suddenly someone pointed and at the same time beckoned for silence, and there not more than three yards away from us on the lowest branch of one of the oaks forming the avenue was a bird. He was sitting in a huddled position, as if he were in pain, and uttered this sharp shrill screech every few moments.

He looked about nine inches in length with a short, thick, black beak and tail. His chest was white, flecked with black and his head and back were black.

We now watched with amazed interest, for never before had we seen a bird sit still and boldly face so many admirers. He still kept calling, and some of us were contemplating laying hold of him to see if he was hurt, when suddenly he again began to get excited and rapidly repeated the cry. We watched breathlessly while two little robins flew on to the oak, then down to the branch on which he was sitting, and hopped along it towards him ; while he screeched the louder, opening his mouth to an enormous extent, until finally a worm was popped into it and the robins flew away.

We watched this happen several times, following the baby cuckoo—for it was none other—when he took short flights from tree to tree. We, too, were very much excited at what we had seen and praised our luck at having had the opportunity of watching the greedy and lazy habits of the Piet-Mijn-Vrouw,* and the devotion of the little Jan Frederic.†—I am, Sir, yours etc.

FLORA KING.

* *Cuculus solitarius.* † *Cossypha caffra.*

SIR,—There are endless opportunities at Kirstenbosch of studying that most interesting phenomenon in nature—"brood-care"—as exhibited by birds, spiders and insects. That spiders are among the most devoted of mothers no one will deny, for do they not sacrifice even their own husbands for the well-being of their offspring? The common "daddy-long-legs" (*Pholcus phalangioides*) carries her sack of eggs about with her if she is disturbed, and the "wolf" or hunting-spiders have their cocoons attached to the spinnerets. Deep down in the earth the trap-door spider jealously guards her precious eggs. The *Lathrodectus*, too, has her nest, at any rate, under her eye, for whenever one sees those small white spheres, about the size of a pea, one is sure to find the mother in some corner a few inches off, her lair, however, continuous with the cobwebbed network in which the nests are suspended. Now these are all very evident instances of brood-care, but the case of *Palystes* is a much more subtle one. She is a medium-sized spider, greyish-brown in colour, and often pays one an evening visit. The only hospitality you can offer her are the flies which are dozing on your ceiling, or the mosquitos which are waiting on your walls till you have gone to bed, and are more or less a passive resister. She builds no web but her nest proves her to be no mean artist. It is the large one, suspended in some sheltered bower, and composed of fairly large-sized dead leaves loosely woven together in two or three layers, the whole being covered with a sheet of thin but tough satin--except where an obstinate petiole *will* poke through. Somewhere inside this delightful nursery is the eggsack itself, swathed as it were in soft cotton-wool, and reminding one of a snug cot covered with the cosiest of eiderdowns.

It was about the middle of April when we, a party of nature-students, were admiring the outside of one of these nests and its moorings, and wished to see how things had been arranged inside. The nest was therefore dislodged and a small opening torn (sacrilegious act !) in the satin covering. We poked among the leaves and found the egg-sack rather towards the side of the nest and in the upper half. Then, as far as we were able with our clumsy fingers, we minimised the damage done, and placed the nest in a sheltered bush, hoping all would still go well in spite of our investigations into the realm of spider-housewifery. Two days later we passed the same spot, and behold ! the nest once more suspended by its silken cables, and the satin covering repaired so that *we* could not see the join. Where was the watchful one and what must her feelings have been if she had seen us with the nest ? Is she always on guard, hidden from our view, or does she come periodically to see if all is well with the brood?

On another occasion, this time in March, someone thoughtlessly removed a beautiful new nest which had been placed in the group of fluitjes-riet or pan's-pipe grass (*Phragmites communis*) growing in Pan's Pool in the upper portion of the Dell. It was put back at once in some herbage close by, and next day we found it with the cables renewed, and once more suspended clear of the surrounding growth. A week later it was gone—perhaps tidied away by the coloured gardener to whom, no doubt, this charming and interesting object would appear the most useless litter.—I am, Sir,
Yours etc.

L. BOLUS.

SOUTH AFRICAN HEATHS.*

FOR a century and a half South Africa has been famous for its heaths. Several fine collections existed in Great Britain during the latter part of the eighteenth and early part of the nineteenth centuries—notably His Majesty's collection at Kew, the Duke of Bedford's at Woburn Abbey, Mr. Geo. Hibbert's at Clapham, and the collection at the Edinburgh Botanic Gardens under the care of W. McNab. In the near future we have every hope of being able to add the Kirstenbosch collection to this list.

Distribution. The heaths and their immediate allies (embraced in the term *Ericoideae* as distinct from the other large groups in the Family embracing the Rhododendron and Arbutus divisions), belong to Europe, the Mediterranean Region, and South Africa. Here they are massed in the South-Western Districts and extend eastward in the Coastal Districts as far as the Albany Division, occurring in the Zwartbergen and Drakensbergen in considerable quantities. The Cape Peninsula, reckoned as consisting of 192½ square miles, alone has 95 species, of which *E. cyrillaeflora*, *E. catervaeflora*, *E. Fairii*, *E. Urnaviridis*, *E. Halicacaba*, *E. gilva* and others have not hitherto been recorded from elsewhere. Other centres, too, are noted as having certain species peculiar to the District, *e.g.*, Riversdale, where we find the white or pale pink "Albertinia heath" (*E. Bowieana*) the orange and green sticky "Chinese-lantern heath" (*E. blenna*), and the deep red, or pale pink, globular "Riversdale heath" (*E. ardens*). Elim is specially known as the home of the white and red "Elim heath" (*E. regia*), in the same way as French Hoek is for the waxy pink "French Hoek heath" (*E. ventricosa*), and Ceres for its yellow and red "petticoat heath" (*E. Thunbergii*), and its dark, dull red "cup-and-saucer heath" (*E. glauca*). The Caledon Division is so richly endowed with the finer kinds of heath that it is difficult to select a few examples. There are the "yellow bell" (*E. campanulata*), "Bot River heath" (*E. monsoniana*), "vlei heath" (*E. perspicua*), and the many beautiful vase-shaped heaths like *E. Irbyana*, *E. ampullacea*, *E. retorta*, and *E. aristata*. Montagu Pass has several fine species belonging to the group with long, tubular or trumpet-shaped flowers, *e.g.*, *E. densifolia*, *E. speciosa*, *E. dichrus*, and *E. glandulosa*, which latter, with *E. pectinifolia*, extends to the Van Staden's Mountains, near Port Elizabeth, while Grahamstown has the soft, purplish-pink "Grahamstown heath" (*E. Chamissonis*). On the other hand there are a few species with a wide distribution—notably *E. cerinthoides* which extends from the South-Western Districts to Abyssinia.

*These notes are a repetition of those I used for an article, written in conjunction with Dr. E. P. Phillips, which appeared in Part IV of the Journal and now is out of print. A few additions have been made.

Description. All the *Ericae* are evergreen shrubs, and show a great divergence in their habit of growth. Some are large shrubs, as *E. triflora* on the Contour Path at Kirstenbosch, or even trees as *E. caffra* in Platteklip Gorge; others are slender scramblers, peeping from under the shade of a more sturdy growth, as *E. thymifolia* does, or, like *E. cyrillaeflora*, jewelling the delicate soft verdure that often veils our mountain springs. On the top of Table Mountain, sheltered behind friendly ridges, and lying nearly flat, others are found growing in the crevices of rock, like *E. petiolaris*, or, like the dainty *E. marifolia*, assuming the mat-like habit of the tufts of moss in whose soft cushions they seem to nestle. For the most part, however, they are medium or small shrubs, such as are found on the flats or exposed mountain-sides, and have a strong hardy look quite in keeping with the character of their surroundings and their time-honoured companions—the Proteaceae and Restiaceae. No epiphytes are known.

In their leaves heaths show the very marked xerophytic character of the reduced leaf-surface, and most of them "set" their leaves tip to the direct rays of the sun, as well as crowding them so that they overlap and shade one another. In addition to these means of reducing the transpiration the great majority of species have their leaves felted with hairs beneath, and their margins rolled back so that a narrow cool damp channel is formed on the under surface. This type of leaf, admirably adapted to meet the exigencies of the climate, is known as the ericoid type, and is found in many other families of plants of the "macchia" or hard-leaved-shrub-formation of the South-Western Districts. Some few species, however, such as *E. thymifolia* and *E. hispidula* have flat or almost flat leaves (Plate Three, Figs 8 and 18), or show both types, those below in the shade being flat, while the upper ones have the margins rolled back.

In their method of obtaining food from the soil heaths cannot be described as being strictly independent, for instead of absorbing with root-hairs in the usual way they are provided with a fungus whose threads do the absorbing for the heath, the fungus deriving some benefit, too, from the partnership.

The bulk of the species have the leaves arranged in whorls which are usually 3—4-nate, more rarely, as in *E. sessiliflora*, 6-nate, and, as in *E. purpurea*, 8-nate, or, as in *E. virginalis*, 2-nate (Fig. 1). They are shortly petiolate, exstipulate, simple, indistinctly pinnately netted-veined, linear or rarely ovate or oval, entire.

Normally each flower has a peduncle, provided with bracts, and arising from the axil of a foliage-leaf, either on the main branches (3, b) or on short lateral branches (3, c, d). These short lateral branchlets often crowd at the apex of a main branch, as in the common "red Erica" (3, a) and make a more conspicuous

mass. The flowers (1) themselves are regular, except that in many of the "bird-heaths" the corolla has the same curve as the sugarbird's beak and so is slightly oblique. Their parts are arranged in fours and there are five whorls, so that each flower is composed of twenty members. The four sepals are either leaf-like and small or they may be large and brightly coloured. They are usually quite separate from one another, but the four petals are always joined up (4), and make corollas with a most charming and fascinating variety of shapes which may be summed up in the lines :—

Bell and cup and trumpet,
Tiny bowl and jar—
With lobes bent back, or upright,
Or spreading like a star.

The free portions or lobes are usually much shorter than the joined-up portion or tube.

The stamens (1, c) are free from one another and are all of the same length. They are either enclosed within the corolla or extend beyond it. The anthers have two lobes and shed their pollen by means of pores. They present a great diversity of form (5, a-h), some having basal appendages. The carpels (1, e, f) are almost united throughout, the very faintest division into four being visible in the stigma. A section through the ovary, however, clearly shows the four components and the numerous ovules in each cell of the ovary. A glance at the plate (6, a to e) will serve to illustrate some of the more usual forms of ovary and stigma. Fig. 6, d shows the large flattened form of stigma which often occurs in a flower with an open "bowl" corolla, where it is large enough to shelter all the anthers clustering beneath it. The stigmas always project beyond the stamens and nearly always beyond the corolla.

Honey is provided in the nectary (an outgrowth of the receptacle) which surrounds the base of the ovary (1, e).

Dispersal of Seed. Persisting on all through the fruiting stage, and even after the seeds have been shed, we find the hardy calyx and corolla. The fruit itself is a capsule which splits down the midrib of each carpel, gradually letting the small light seeds free to be dispersed by the wind-swayed motion of the plant. Sometimes the seeds fall into the corolla and the "censer-mechanism" is again effectual.

Pollination. The attractiveness of the flowers and their liberal provision of honey at once pronounce adaptations for cross-pollination, and we proceed to discover the pollinating-agents, and the floral-mechanisms which ensure its being effected. The species with long-tubed corollas, which are often delicately curved, are clearly suited to bird-pollination, and the other species to insect-agency. To keep off "unbidden guests", like the various crawlers, the corollas are often very sticky, but it is interesting to note, especially among the group which has the lobes spreading out star-wise, as if to afford a landing place for a flying-insect, that these lobes are *not* sticky when the rest of the corolla is; and, further, that when the whole of the corolla is sticky the flower is adapted to pollination by sugar-birds who can sip while hovering. The stigma is always ahead of the stamens in position, so that it is touched first by the visiting insect bringing pollen from another flower. As the stamens are all the same length the anthers are side by side, and they frequently adhere so closely that a touch from without is necessary to release the tension, and shake out the pollen ("loose-pollen mechanism"). Some of it is light enough to be blown upon the stigmas of neighbouring flowers and some is borne off by the visiting-insect to another flower.

Uses. In France the rootstock of the common heath in the South (*E. scoparia*), known as "bruyère", is used for making "briar" pipes, and in ancient times the Greeks considered their heath had medicinal properties. It was said to break stone in the bladder, so they called it "ereike"—"the breaker." This name was adopted by Linnaeus for the genus, and the etymology clearly indicates the pronunciation of the word—the "i" being long and not short, as is usually supposed. Up to the present our heaths, except as a means of providing honey, have not had the economic value in their own land which they richly deserve. In Europe for a century and a half they have been cultivated and sold. Would it be too much to hope that in the near future we shall hear of flourishing heath-farms in our midst, where cut flowers are sent to the markets already created for them in Cape Town and Johannesburg; where seeds could be collected to supply the demand made by all the botanic gardens in the world; and where pots of heath may be produced to be sold in our shops? In this way the labour of the flower-sellers in Adderley Street, now a serious menace because of the unscrupulous and ignorant manner in which the picking is done, would be directed into safe and more profitable channels, and the heathlands of South Africa, now being burnt out, would be preserved to our race for all time. For we must not forget that man cannot live by bread alone; nor will our children work for bread alone, as their fathers were forced to do before them. Their joy in the beautiful things of their native land is visibly increasing because they are being taught to understand them, and, when we consider what has been accomplished in the few short years of the existence of Kirstenbosch, this dream of the preservation of our heath-flora seems on the very verge of being realised. It is surely no far cry from the training-ground of Kirstenbosch to a heath-farm in the Caledon Division; and to those of us who remember the words of the greatest Teacher the world has known, how that faith can remove mountains, this cry becomes less far and more audible each day.

Classification. A genus as large as *Erica*, comprising as it does over 500 species, would be an unwieldy mass to deal with unless certain big divisions were made before the individual species were considered. The first two groups (7 A, and B) are differentiated on the basis of the relative size of calyx and corolla—the corolline group containing all those in which the corolla is distinctly

larger and more showy than the calyx, and the calycine group including those having a showy calyx, half as large as the corolla or larger. The first group (A) is divided into those having trumpet-shaped corollas, half an inch long or longer (A, 1), those having a jar-shaped corolla with star-spreading lobes (A, 2), and those with smaller corollas of various shapes. The two sub-divisions in the second group (B) are again distinguished mainly on the shape of the corolla which is usually much more widely open at the mouth in Platystoma (or wide-mouth) (B, 2) than it is in Chlamydanthe (or cloaked-flower).

The following is a key* for the identification, in the field, of the species of Erica native to Kirstenbosch :—

Corolla hairy
 Corolla trumpet-shaped
 Flowers more than 3 in a cluster **cerinthoides, L.**
 Flowers 1-3 in a cluster
 Leaves 6 in a whorl **coccinea, Berg.**
 Leaves 4 in a whorl **curviflora, L.**
 Corolla jar-shaped
 Leaves 4 in a whorl ; corolla coarsely hairy **hirtiflora, Curt.**
 Leaves 3 in a whorl ; corolla velvety **pubescens, L.**

Corolla glabrous
 Anthers projecting beyond the corolla
 Corolla curved, more than ¼ in. long **Plukenetii, L.**
 Corolla not curved, less than ¼ in. long
 Sepals less than half as long as reddish corolla
 Leaves open-backed or partially so **thymifolia, Wendl.**
 Leaves not open-backed (ericoid) **nudiflora, L.**
 Sepals about as long as white corolla **imbricata, L.**
 Anthers enclosed within the corolla
 Corolla trumpet-shaped
 Corolla with 4 depressions at the base **mammosa, L.**
 Corolla not having 4 depressions
 Sepals hairy or downy ; corolla red **coccinea, Berg.**
 Sepals glabrous, corolla purplish pink
 Corolla up to 1 in. long **purpurea, Andr.**
 Corolla up to ½ in. long **conica, Lodd.**
 Corolla globosely jar-shaped, or bowl-shaped
 Sepals large, about as long as the corolla tube
 Flowers pink **baccans, L.**
 Flowers white **triflora, L.**
 Sepals small, much shorter than corolla tube
 Stigma small ; corolla purplish pink **viridipurpurea, L.**
 Stigma widened (peltate) ; corolla greenish **hispidula, L.**

*In using this key it should be remembered that there exist other genera of Ericaceae besides Erica itself, and these plants may have a heath-like appearance. *Blaeria ericoides*, which flowers on the Aloe Kopje in March, is the most likely to lead to confusion, until it is noticed that the flowers possess four stamens only, whereas practically all true heaths have eight stamens. Species of Simocheilus, Scyphogyne and Philippia also grow in or just outside Kirstenbosch, but these are not likely to cause trouble to users of the key.

Evergreen shrubs ; erect, decumbent and trailing, or prostrate ; xerophytic ; roots provided with mycorrhiza ; heteromerae. Leaves usually erect or ascending, whorled, petiolate, exstipulate, simple, linear, oval, or ovate, acute or obtuse, margins entire and usually revolute, glabrous or hairy ; flowers solitary in the axils of leaves on the main branches or on short lateral branchlets, which latter are sometimes crowded at the tips of the branches —usually pedunculate, the peduncle with 1-3 bracts, regular or very nearly so, tetramerous. 5-whorled ; sepals usually free, sepaloid or petaloid, together with the corolla persistent in fruit ; corolla gamopetalous with contorted aestivation, glabrous or pubescent, often sticky ; stamens free, included or exserted, anthers dorsifixed or basifixed, frequently with dorsal appendages, dehiscing by pores ; nectary a receptacular disk ; gynaeceum syncarpous, stigma usually exserted, small or dilated, style slender, ovary sessile or more rarely stipitate, cylindrical, ovate, obovate or globose, glabrous or hairy ; fruit a loculicidal capsule, the seeds small and light, distributed by wind (censer-mechanism) ; pollination effected by birds and insects (ornithophilous and entomophilous flowers) ensured by stigma projecting so as to be touched first and "loose-pollen" mechanism. Used in horticulture and bee-keeping.

Summary.

L. Bolus.

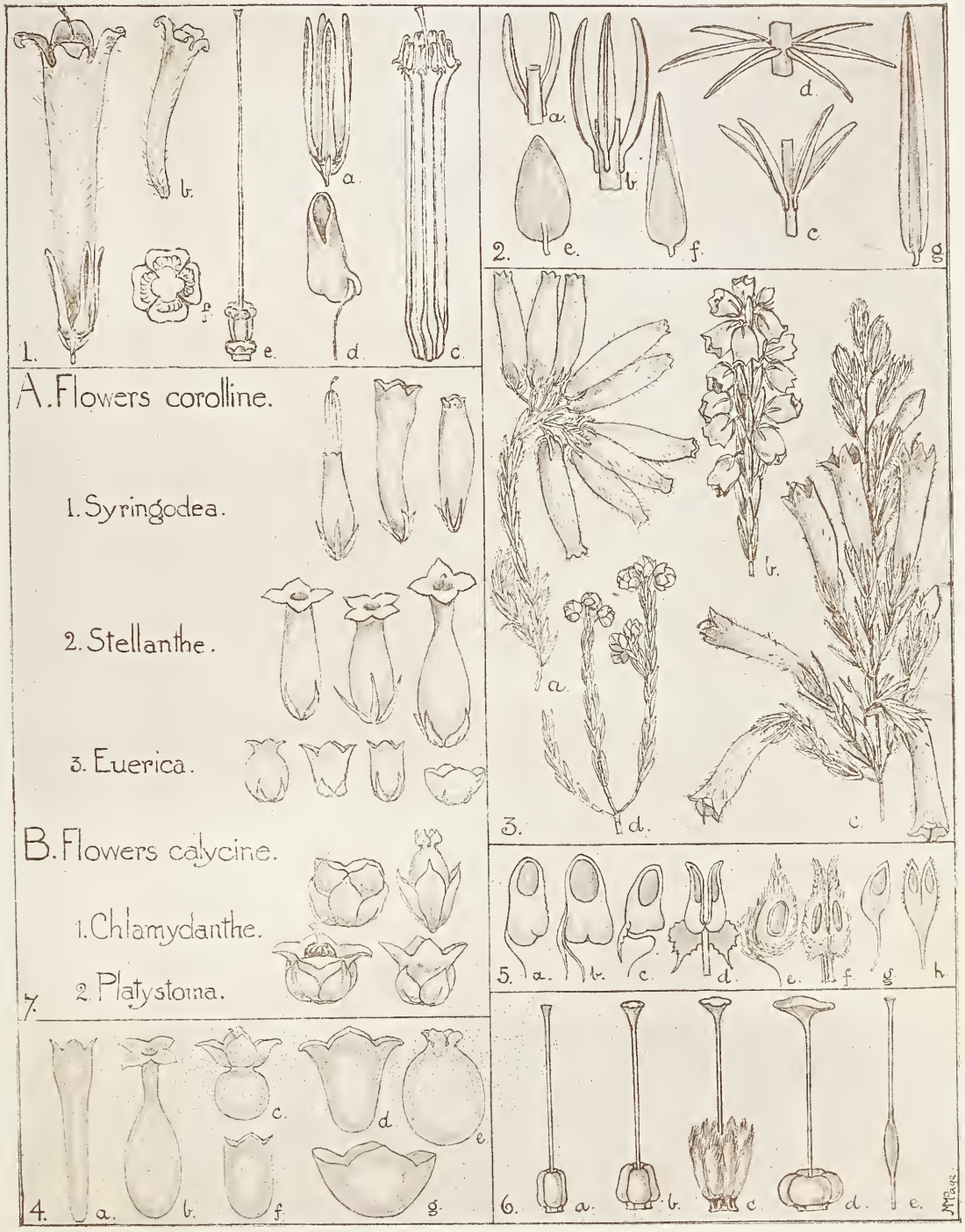
Bolus Herbarium.
University of Cape Town.

Explanation of Plate Three: South African Heaths.

1. Typical Heath Flower.—Figure *a*, peduncle, bracts and calyx ; *b*, corolla ; *c*, androecium and gynaeceum ; *d*, anther and upper portion of filament ; *e*, gynaeceum ; *f*, section of ovary.
2. Leaves and Leaf-arrangement.—Figure *a*, whorl of two leaves ; *b*, do. of three leaves ; *c*, do. of four leaves ; *d*. do. of six leaves ; *e*, open-backed leaf ; *f*, leaf with margins partially revolute ; *g*, typical ericoid leaf.
3. Arrangement of Flowers.—Figure *a*, crowded at the tip of a branch ; *b*, in the axil of the leaves of the main branch ; *c*, *d*, in the axil of leaves of lateral branchlets.
4. Shapes of Corolla.—Figure *a*, trumpet ; *b*, *c*, *e*, jar or vase ; *d*, bell ; *f*, cup ; *g*, bowl.
5. Anthers.—Figures *a-f*, dorsifixed or lateral ; *g*, *h*, basifixed or terminal ; *a*, *b*, *c*, *d*, *g*, *h*, pore in upper half of lobe ; *e*, *f*, in middle of lobe ; *a*, muticous ; *b*, aristate ; *c*, aristate-cristate ; *d*, cristate.
6. Gynaeceum.—Figure *a*, cylindrical glabrous ovary, simple stigma ; *b*, ovate ovary, capitellate stigma ; *c*, obovate villous ovary, capitate stigma ; *d*, depressed-globose ovary, peltate stigma ; *e*, stipitate narrow-cylindrical ovary, simple stigma.
7. Classification of Genus into two main groups A and B, sub-divided into five smaller divisions based on perianth characters.

"Ons nasionale tuin, Kirstenbosch, lê hom toe op die in stand hou en aankweek van inheemse plantegroei en het onlangs 'n groot lap grond by Matjesfontein in die Karroo persent gekry om sy werk ter plaatse voort te sit. Ek vertrou, dat die studie van natuurlike herbebossing, in wye sin herbedekking van die aarde met sy kosbare plantekleed, een van die vernaamste werke van die inrigting sal wees."

Dr. Schonken,
"Dorre Suid Afrika," p. 327, 1921.



M. M. Page del.

Details of the Structure of Heaths.

THE CULTIVATION OF HEATHS.

AT the present time Heaths are practically a nonentity in the gardens of the world. In Europe the Heatheries of a century ago gradually lost favour until 50 years later there were apparently few left that could be looked upon as comprehensive collections or a feature of the gardens. Twenty-five years later they had dwindled down to collections in the principal Botanic Gardens only; their use for decorative purposes being catered for by several nurseries who grew in thousands perhaps half a dozen varieties, mostly if not all hybrids of the softer-wooded species. At the present time the Botanical collections have practically gone, and their culture is confined to the few varieties of market growers. In Australia, around Melbourne, are one or two nurseries who have collections of about 30 varieties under cultivation in quantity. These are the only instances I know of where Heaths can be said to form a culture.

South Africa has therefore an unique opportunity as the Headquarters of Heaths to form a Heath Garden or Ericetum that will become a world feature.

A close study of the natural environments of each species will assist greatly to a knowledge of their requirements under cultivation. For general practice they can be divided into two groups: Dry hillside plants like *Erica baccans*, *E. cerinthoides*, *E. Bowieana*, etc., which are very hard-wooded and of twiggy bushy growth; and Streamside or Swamp plants like *E. curviflora*, *E. perspicua*, *E. colorans*, *etc.*, which are much softer-wooded and will make several feet of growth in a season. Nearly all demand full sun, a few like *E. thymifolia*, *E. triflora*, *E. catervaeflora*, *etc.*, are partial to shady places, slopes or kloofs.

Given good seeds Heaths are readily raised and quickly reach the flowering stage, most doing so in their third year. A compost made up of equal parts of sand, leaf-mould, peat and loam, suits the hillside species, and one of equal parts of sand, leaf-mould, and peat will suit the moisturel oving ones. Pots or tins may be used to agree with the quantity of seed. Each should be carefully crocked to one quarter of their depth, with a layer of moss over the crocks. The compost, being well mixed, should be passed through a ¼-inch sieve, a little of the rough material placed on the moss, and the fine soil used to fill up to 1 inch from the rim. Press each layer of material firm as placed in pots, and the surface to a firm and level finish. Thin sowing is necessary—say, ten to the square inch. *Sprinkle* a little coarse sand on the seeds, but never *cover* them with sand or soil. Watering must not be done overhead until the seedlings are strong. Instead, immerse them in water to within an inch of the surface of the soil, and allow to stand until the surface is moistened by capillary attraction. Place a pane of clear glass on the top of the pot to prevent evaporation, and shade with a piece of paper until germination, when more air and light must be given by tilting the glass. A close frame is a suitable place to stand the pots, but if not available the pots can be plunged in the open, and the glass will carry off heavy rains. The pots of swamp heaths can be stood in an inch of water in a saucer or tray, and fresh water added to prevent stagnation. February and March are the best months for sowing, followed by August and September. When large enough to handle the seedlings can be pricked off into flat tins, spaced 2 inches apart, and using a similar compost as for the seeds. A little shade and syringing will help to establish them quickly. It is important, if the tins of swamp heaths cannot be stood in shallow water, that an abundance of water be given them.

In forming beds of heaths, or a heathery, it is essential the soil should be made to approximate that required by the group to which the plants belong, and in the case of swamp heaths a sufficiency of moisture percolating through at about a foot from the surface. Where these conditions are available naturally, the only difficulty to surmount is a supply of sound seeds, which, of course, must be secured from plants in a wild state.

To increase the stock of established plants propagation by cuttings, as well as seeds, can be practised. The best cuttings are the tips of the twiggy little shoots around the body of the plant, not from the long vigorous flowering growths. A length of about 1 inch is sufficient and the leaves on the lower half should be removed with a pair of sharp scissors. Pots should be crocked to half their depth, and a compost of one of sand to two of fibry peat used with a surface of fine dry sand, not beach sand. Insert the cuttings not more than an inch apart, and to half their length. Water freely, and when drained, stand in a close frame on a bed of ashes, or plunge into the soil. Shade freely and keep a moist atmosphere round them. Drip or overwatering the soil will cause damping off wholesale. A genial moisture-laden atmosphere of about 60 degrees is the ideal. As growth commences air should be gradually admitted, and the shading as gradually reduced. When hardened off the young plants can be pricked off in the same way as seedlings. As soon as young plants from either method are 2 or 3 inches high they should be moved into single tins with a somewhat coarser soil, and firmer potting.

J. W. MATHEWS.

Kirstenbosch, April 19th, 1922.

THE BOTANICAL SOCIETY OF SOUTH AFRICA.

ANNUAL REPORT, 1921.

THE Council has pleasure in submitting the Ninth Annual Report of the Society.

FINANCIAL.—The sum of £491 7s. 5d. has been available for the purpose of augmenting the funds of the Trustees of the National Botanic Gardens, as compared with the sum of £373 8s. in 1920.

MEMBERSHIP.—The membership of the Society stands at : Life Members, 54 ; Family Members, 48 ; Members, 407 ; Associates, 287—total 795.

ANNUAL GATHERING.—The Annual Gathering at Kirstenbosch was held on Saturday, November 19th, and was well attended by members and their friends.

COUNCIL MEETINGS.—Three meetings of the Council have been held during the year.

ANNUAL GENERAL MEETING.—At the Annual General Meeting held on March 31st the following officers were elected for the year :—

President : The Right Hon. Sir James Rose-Innes, K.C.M.G.

Vice-Presidents : Sir Lionel Phillips, Bart., the Hon. Sir Lewis Michell, K.C.V.O., and Max Michaelis, Esq.

Members of the Executive Council : Mr. W. Duncan Baxter ; Mrs. F. Bolus ; Mrs. Carter, C.B.E. ; Mr. F. E. Cartwright ; Professor R. H. Compton ; Mr. Justice M. de Villiers ; Mr. W. A. Eaton ; Miss Fairbridge ; Mr. W. Greenacre, M.L.A. ; Mr. P. S. Horne ; Mr. H. T. Twentyman-Jones ; Lady Rose-Innes, C.B.E.; Mrs. Brown-Lawrence ; Mr. J. Storr Lister, I.S.O. ; Mr. A. H. Reid ; Miss E. Struben ; Professor D. Thoday ; Mr. A. Walsh ; Mr. W. Webber, M.L.A. ; Miss F. M. White.

The Council appointed Mr. W. A. Eaton as Chairman ; Mr. H. T. Twentyman-Jones, Hon Treasurer, and Mrs. F. Bolus, Hon. Secretary. Mrs. H. S. van Zijl was appointed as a member of the Executive Council to fill the vacancy caused by the death of Mrs. Brown-Lawrence.

JOURNAL.—The Journal of the Society was published in June and the Council wishes to express its appreciation and thanks to the Editor, Professor Compton, for again producing so successful an issue. It contains an important account of the geology of Kirstenbosch by Mr. A. R. E. Walker, of the Cape Town University, to whom we offer our grateful acknowledgments, as well as to all the other contributors. A new and welcome feature is the addition of a list of seeds available at the National Botanic Gardens for distribution among members and associates of the Botanical Society, and to Botanical Gardens. It is gratifying to note that the list contained four of the protected species and it is hoped that from year to year seeds of more and more of the protected species may be provided.

BOTANY RAMBLES.—The botany rambles over Kirstenbosch, instituted by the Society and conducted by the Hon.. Secretary throughout the school-year, have been much appreciated. Their scope has been extended to meet the needs of various standards in some of the Primary Schools. The total number of attendances was 1,128, as compared with 490 in 1920.

VACATION-COURSES.—Four vacation-courses in Botany and Nature Study have again been conducted under the auspices of the Society by the Hon. Secretary, viz., one in January of three weeks' duration, and three of one week's duration each in April, June, and September. These were attended by a total of 39 students (as compared with 34 in 1920) who resided at the Kirstenbosch Hostel for the period of the Course, and who all warmly acknowledged the benefits which Kirstenbosch had afforded them.

INFORMAL GATHERINGS.—Three informal gatherings (instituted by the Council for the purpose of keeping members in touch with the work going on in the Gardens) were held during the year, viz., in February, May and September, the dates being duly notified in the press. The Director conducted parties round, giving interesting talks on many of the noteworthy plants. It is hoped that these will be continued.

GARDENING DEMONSTRATIONS.—Opportunity was taken of two of these occasions and of the Annual Gathering at Kirstenbosch to have demonstrations in gardening. The Curator, Mr. Mathews, undertook the work enthusiastically and gave three most interesting demonstrations, viz., in seed-sowing, propagation by cuttings, and in pruning. The examples chosen for illustration were native plants of South Africa, so that members and their friends had the advantage of Mr. Mathews' unique practical experience of these plants as well as of his professional knowledge. Hearty thanks are due to Mr. Mathews for all the trouble he has taken. Seeds and cuttings were liberally distributed at each demonstration.

ENTERTAINMENT OF MEMBERS OF THE MEDICAL CONGRESS.—With the view of making the Gardens known to medical men from all over South Africa and of obtaining their support, advantage was taken of the occasion of the Medical Congress, held in Cape Town in October, to invite the members and their wives to visit the Gardens. Tea was provided and served at the Director's House and the whole function proved a successful one, largely owing to unstinted efforts on the part of Mrs. Compton to whom we tender our acknowledgments.

The Council wishes to express to Mrs. Bolus their hearty thanks and appreciation for her continued interest and work in connection with the spreading of

the love of the Flora of South Africa, especially shown in her practical work in conducting botany rambles, vacation-courses and other meetings at Kirstenbosch.

Appeal for New Members.—The Council feels that the various activities of the Society fulfil a demand which has not hitherto been supplied elsewhere and it, therefore, renews its appeal the more earnestly to each member and associate to do all in his power to add to the membership and so augment the funds necessary for the development of Kirstenbosch.

The Council has to express its indebtedness to Mr. R. L. McDonald for auditing the accounts, to the City Council and the South African Association for the use of rooms for meetings, and to the Press for valuable assistance in reporting matters of interest and calling attention to the work of the Society.

W. A. Eaton,
Chairman.

Cape Town,
March 27th, 1922.

PROGRESS AT KIRSTENBOSCH.

THE following summary of the principal work done in the Gardens, from June 30th, 1921, to March 31st, 1922, is recorded for the information of those members of the Society who are unable to keep themselves acquainted with the progress by frequent visits to Kirstenbosch.

All the collections of succulents in the Nursery have been overhauled, repotted and propagated where necessary; 120 tins of various Proteaceae, 65 pots of Heaths and 60 tins of Mesembrianthemum seeds have been sown. The following economic plants have been raised in sufficient quantities to form permanent stands: *Anthemis nobilis, Valeriana officinalis, Aconitum napellus, Mentha pulegium,* two varieties of *Rosa damascena,* and the South African Liquorice.

The propagation of trees and shrubs, and of showy plants such as *Sutera grandiflora, S. phlogiflora, Diascia aliceae, Orthosiphon canescens, Crotalaria agatiflora,* etc., has received increased attention with a view to effective display on various sites.

In the Pelargonium Garden 2,000 plants and cuttings have been put out.

In the Daisy Garden 6,000 seedlings and cuttings have been planted, and the propagation of shrubby composites carried on as well as the sowing of further seeds with a view to an increased display in season.

An addition of 117 plants was made to the Protea Garden, including a fine lot of *Faurea McNaughtonii.*

The Heath collection has been increased by 123 plants, including several rare species.

The Mesembrianthemum beds near the entrance have been re-formed, and considerable numbers of cuttings put in.

Useful masses of species, mainly from the Transvaal, have been added to the Aloe collection. At the front of the Kopje the kerbing and guttering have been completed to the N.E. corner, and the road gravelled.

The renovation of the flower beds on the Terrace is well in hand, sufficient quantities of suitable material having been raised.

The new work on the north bank of the Fern Dell has been completed between the stream and the main path from the Aloe Kopje to the Bath. Approximately, 400 yards of stone kerbing and 106 yards of guttering have been laid; 210 square yards of the paths cobbled and the remainder gravelled. The water service has been extended over this site, 550 feet of ¾-inch pipes being laid and six taps fixed. The beds and banks have been filled up to levels, and numerous species of dwarf Crassulas planted for edgings.

On the Karroo Garden 6,200 square yards have been trenched and cleared of stumps; the paths cut out and graded and 26 holes dug for five species of Tree Euphorbias.

In the Economic Grounds stands of the following have been planted out from material raised in the nursery: *Leyssera gnaphalioides, Dodonaea Thunbergii,* " Zwartbos Kortboon," and a few plants of two varieties of Rooibos, *Digitalis purpurea, Atropa belladonna, Tanacetum vulgare, Foeniculum vulgare, Artemisia absinthium, Sambucus niger, Datura Metel* and *Pueraria Thunbergiana.* The varieties of Hops were lifted for propagation and have yielded sufficient to plant well over an acre. An area of 650 square yards of Black Peppermint was planted for cutting and yielded 13 bags of wilted material for distillation.

Preparation of the ground for hedges to the permanent nursery and the Economic Grounds bordering the Deviation road has been started.

To improve the condition of the trees of the Chestnut Avenue, wet places have been sluited, shallow furrows formed to divert surface water, walls of original holes broken up with dynamite, and the ground broken up and graded to a full width of 16 feet along each line of trees.

Permanent labels have replaced the wooden ones to determined species of Proteas, Heaths, Aloes, Daisies, Pelargoniums, Economic plants, and in the Fern Dell.

The Circular Drive, 745 yards in length, has been completed.

The Rustic Footbridge near the Ruins has been renewed.

The under-structure of a Stone Bridge, in the Oak Avenue, over the Skeleton Stream, has been built, the stream-bed stone-packed and grouted in cement, and a section of the span and part of the west side wall built.

Two huts, for native labour, semi-detached, each 10 feet by 12 feet, have been built in stone with iron roof.

J. W. Mathews.

Kirstenbosch, April, 1922.

NATIONAL BOTANIC GARDENS.

Kirstenbosch, Newlands, Cape.

SEED LIST, 1922.

The following seeds are available for distribution or exchange to Members and Associates of the Botanical Society of South Africa, and to Botanical Gardens. Application should be made to the Director.

AFRICAN SPECIES.

Abutilon sp.
Acacia giraffae.
,, sp.
Acokanthera spectabilis.
Adiantum sp.
Andropogon sp.
Agapanthus umbellatus (blue and white vars.).
Albuca major.
,, sp.
Aloe Kraussii.
,, rubrolutea.
Anoiganthus breviflorus.
Anthocleista zambesiaca.
Antholyza paniculata.
,, praealta.
Arctotis stoechadifolia.
Asclepias Burchellii.
,, sp.
Aspidium aculeatum.
Asplenium aspidioides.
,, protensum.
,, sp.

Begonia Dregei.
,, sp.
Blechnum tabulare.
,, sp.
Brachystelma Gerardi.
Bulbinella robusta.
,, sp.

Calodendron capense.
Calpurnia villosa.
Cedrus atlantica glauca.
Cheilanthes multifida.
,, sp.
Chloris virgata.
Combretum Kraussii.
Commiphora sp.
Cotyledon sp.
Crassula sp.
Crinum longifolium.
Crocosmia aurea.
Crotalaria capensis.
Cucumis Naudianus.
Cyathea Dregei.
Cyclopia sp.
Cyrtanthus lutescens.
,, sp.
Cytisus candicans.
,, pallidus.
,, populifolius.
,, proliferus.
,, stenopetalus.

Dierama pendula.
,, pulcherrima.
Dimorphotheca Ecklonis.
Dipcadi sp.
Dodonaea Thunbergiana.
Dryopteris Bergiana.

Encephalartos sp.
Eragrostis curvula.
Erlangea sp.

Felicia capensis.
,, rotundifolia.
Ferraria undulata.

Gerbera sp.
Gladiolus callistus.

Haplocarpha scaposa.
Haworthia margaritifera.
,, sp.
Hemitelia capensis.
Hibiscus diversifolius.
,, sp.
Homeria lilacina.

Ipomaea sp.

Lawsonia alba.
Leucadendron argenteum.
Leucospermum conocarpum.
Luffa sp.

Marattia sp.
Momordica cordifolia.
Moraea bicolor.
,, iridioides.
,, sp.

Ornithogalum Eckloni.
,, sp.

Pandanus sp.
Pellaea sp.
,, viridis.
Peucedanum Galbanum.
Phygelius capensis.
Pittosporum viridiflorum.
Podalyria calyptrata.
Podranea Brycei.
Polypodium lanceolatum.
,, sp.
Protea compacta.
,, cynaroides.
,, latifolia.
,, lepidocarpodendron.
,, neriifolia.
,, obtusifolia.
,, pulchella.
,, rosacea.
,, scolymocephala.
,, sp.
Pseudogaltonia Pechuelii.

Rafnia triflora.
Riocreuxia torulosa.
Rumex Ecklonianus.

Salvia africana.
Satyrium ocellatum.
,, sp.
Scabiosa sp. (pink and mauve).
Senecio sp.
Schizoglossum procumbens.
,, Reitforbii.
Sparaxis grandiflora.
,, grandiflora var. atropurpurea.
Spathodea nilotica.
Stapelia flavirostris.
Strychnos Atherstonei.
,, sp.
Sutherlandia frutescens.

Tecoma Smithii.
Tephrosia Vogelii.

Veltheimia glauca.
Vernonia sp.
Virgilia capensis.

Wachendorffia thyrsiflora.
Watsonia marginata.
,, sp.

Xysmalobium confusui.
,, ensifolium.

EXOTIC SPECIES.

Acacia acanthoclada.
,, accola.
,, adunca.
,, Benneforta.
,, Benthamii.
,, bicolor.
,, Bonariensis.
,, cardiophylla.
,, Cunninghamii var. longiscapa.
,, cyanophylla.
,, Cyclopis.
,, decora.
,, decurrens.
,, decurrens var. normalis.
,, difformis.
,, eburnea.
,, elata.
,, Farnesiana.
,, gladiiformis.
,, glauca.
,, herbosericea.
,, heteroclytii.
,, homulophylla.
,, juniperina.
,, longifolia.
,, longifolia var. floribunda.
,, longifolia var. mucronata.
,, longifolia var. sophora.
,, melanoxylon.
,, modesta.
,, mollissima.
,, myrtifolia.
,, normalis.
,, notabilis.
,, obtusa.

Acacia oxycedra.
,, penninervis.
,, podalyriaefolia.
,, prunosa.
,, pycnantha.
,, rubida.
,, sentis.
,, sepicera.
,, spectabilis.
,, suaveolens.
,, Suma.
,, visco.
,, Wattsiana.
Adina cordifolia.
Albizzia lebbek.
,, lucida.
Anogeissus pendula.
Antigonon leptopus.
Apera arundinacea.
Areca Baueri.
,, sapida.
Arecastrum Romanzoffianum, var. australe.
Argyreia speciosa.
Atropa Belladonna.

Bambusa arundinacea.
Bauhinia purpurea.
,, racemosa.
,, variegata.
Bignonia Unguis-cati.
Bombax malabaricum.
Brachychiton populneus.
Brachycome iberidifolia.
Butea capitata.
,, Gatay.

Callistemon lanceolatus.
,, lineatus.
,, rigidus.
Calotropis procera.
Casearia tomentosa.
Cassia artemisioides.
,, auriculata.
,, australis.
,, bicapsularis.
,, bonariensis.
,, corymbosa.
,, eremophila.
,, fistula.
,, floribunda.
,, glauca.
,, hirsuta.
,, laevigata.
,, occidentalis.
Cassia Sophora.
,, tomentosa.
,, tora.
,, sp.
Casuarina equisetifolia.
Cedrela Toona.
Celtis australis.
Cistus hirsutus.
,, ladaniferus.
,, laurifolius.
,, salvifolius.
Cleome spinosa.
Crotalaria alata.
,, incana.
,, ferruginea.
,, Grantiana.
,, laburnifolia.
,, polysperma.
,, purpurea.
,, retusa.
,, sericea.
,, striata.
,, usambarensis.
,, verrucosa.

Dalbergia lanceolata.
,, Sissoo.
Datura stramonium.
Digitalis purpurea.
Dolichos Lablab.

Erythrina suberosa.
Eucalyptus calophylla.
,, ficifolia.
,, Morrisii.
,, variegatum.
,, sp.

Ficus indica.
,, religiosa.
,, sp.
Foeniculum officinale.

Grevillea Banksii.
,, Banksii var. Forsteri.
,, linearis.
,, robusta.

Hakea sericea.
Hardenbergia monophylla, var. fruticosa.
Heterophragma adenophylla.
Hibiscus mutabilis.

Indigofera australis.
,, cylindrica.

Juniperus cedrus.

Kennedya rubicunda.

Leptospermum flavescens, var. angustifolia.
Leptospermum Nicholsii.
Linum monogynum.
Lolium italicum.
Lomatia Fraseri.
,, longifolia.

Mallotus philippinensis.
Melia indica.
Melia sempervirens.
Melaleuca rosea.
Michelia champaca.
Momordica cochinchinensis.
Moringa pterygosperma.

Notospartium Carmichaeliae.

Oenothera sp.
Olearia albifolia.
,, insignis.
Oxylobium ellipticum.

Pandorea australis.
Parkinsonia aculeata.
Petrophila pedunculata.
Pinus canariensis.
Pittosporum erioloma.
Pleiogynum solandri.
Poinciana regia.

Rhopalostylis sapida.

Stenocarpus sinuatus.
Sterculia acerifolia.
,, alata.
Sophora secundifolia.
Syagrus Weddelliana.

Taraxacum officinale.
Tecoma stans.
Telopea speciosissima.

Vernonia Hookerii.

Washingtonia filifera.
Wigandia caressana.
,, dulensis.
,, imperialis.

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Edgar, Mrs.
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P

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X

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The Botanical Society of South Africa.

OBJECTS:

(*a*) To encourage the inhabitants of South Africa to take an active part in the progress and development of the National Botanic Gardens at Kirstenbosch, a part of the Groote Schuur Estate, in the Cape Province, and to induce them to appreciate their responsibilities therein.

(*b*) To augment the Government grants towards developing, improving, and maintaining fully equipped botanical gardens, laboratories, experimental gardens, etc., at Kirstenbosch.

(*c*) To organise shows at which may be displayed the results of botanical experiments or cultural skill in improving the different varieties of South African flora.

(*d*) To enlighten and instruct the members on botanical subjects by means of rambles, meetings, lectures, and conferences, and by the distribution of literature.

FOUNDED JUNE 10th, 1913.

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Those wishing to become Members of the Society are invited to communicate with Mrs. F. BOLUS, Hon. Secretary, P.O. Box 70, CAPE TOWN.

The Collection of Specimens for Kirstenbosch.

MEMBERS of the Society are invited to assist in stocking the Gardens with native plants. Specimens from all parts of Africa are desired. At present representatives of the following are particularly needed: *Aloes, Bulbs, Ferns, Proteas* (seeds), *Heaths* (branches bearing old flowers), *Succulents, Woody Leguminosae,* medicinal, aromatic and other economic plants.

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INSTRUCTIONS FOR PACKING AND SENDING SPECIMENS.

Cotyledons, Crassulas, Euphorbias, Aloes, Stapelias, Mesembrianthemums and other plants of a like succulent nature, and also the *Epiphytic Orchids,* should be packed dry. Each species should be wrapped in paper and laid tightly in a box. Large specimens of *Aloes, Euphorbias, Cycads,* etc., may be trucked loose.

Large specimens of Tree Ferns should be bound in wet grass or canvas, or with a little damp moss inside the canvas, and the stems should be strengthened with poles.

Ferns, Bulbous and Tuberous Plants in growth and flower need a little damp moss among the roots.

Distinct species of dormant bulbs and tubers, as well as of seeds, should be sent in separate wrappers.

Each consignment should bear (1) the name and address of the sender; (2) the locality in which the specimens have been gathered. Brief notes as to habitat (wet, dry, sun, shade, sand, clay, and so on) are most valuable.

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THE JOURNAL OF THE BOTANICAL SOCIETY OF SOUTH AFRICA

Edited by R. H. COMPTON, M.A., F.R.S.S.Af., Hon. Director, NATIONAL BOTANIC GARDENS :: :: :: KIRSTENBOSCH :: :: ::

Part IX. 1923

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Photo : R. H. Compton.

Silver Trees at Kirstenbosch.

The Journal of the Botanical Society of South Africa.

PART IX. 1923

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PLATES.

Silver Trees at Kirstenbosch. By R. H. Compton.

Native Trees and Tree-Shrubs of Kirstenbosch (I, II). By Miss M. M. Page.

South African Iridaceæ. By Miss M. M. Page.

Carnivorous Plants of the Cape Peninsula. By Miss M. M. Page.

(Miss Page's drawings are supplied to the Botanical Society by courtesy of the University of Cape Town.)

NOTES AND NEWS.

The Membership of the Botanical Society continues to increase, there having been a net increase in all classes of members during the year 1922. The following table shows the growth of the Society since its foundation :—

	Life	Family	Ordinary	Associates	Total
1914	33	22	264	33	352
1915	46	26	263	32	367
1916	49	26	264	45	384
1917	46	24	249	53	362
1918	49	28	281	78	436
1919	50	38	320	84	492
1920	54	45	384	237	720
1921	54	48	407	287	795
1922	55	52	418	301	826

It is interesting to notice that, with the exception of 1917, each year has shown an increase of membership despite the many vicissitudes through which South Africa has passed during this period. The thousand mark is now within sight, and should be within easy reach if every Member would endeavour to add at least one new name to the roll. An application form is enclosed with this Journal. Let each Member do his best to enrol a friend or a relation for 1923.

* * *

The Journal this year appears early in March, and it it hoped to be able to adhere to this date of issue in future. The Editor wishes gratefully to acknowledge the assistance received from Mr. Eaton and Mrs. Bolus, the other members of the Journal sub-committee, from Mr. T. Alcock Dockrall, and from those who have contributed articles for publication.

* * *

This year, on June 10th, the Botanical Society will celebrate its tenth anniversary. The time is appropriate for a review of what the Society has accomplished and for a re-statement of its objects. No one is better qualified than Mr. Duncan Baxter to write an article on these lines, for he has been identified with the Society and with Kirstenbosch since the beginning, and was Chairman of the Council of the Society for its first eight and a half years. Mr. Baxter's article will be read with interest by all members, whether old or new, as a clear and inspiring statement of what the Society is and what it stands for.

* * *

In continuation of her series of articles on the most important plant families in the South African flora, Mrs. Bolus this year contributes a paper on the Iridaceae. This family includes some of the most exquisite of all South Africa's floral treasures, and is largely represented in the native and introduced plants of Kirstenbosch. Mr. Mathews, the Curator of Kirstenbosch, has written an article on the special features of the group from the gardening point of view. Now that the Gardens are attaining a more settled form, and the ravages of the blesmol—that arch-enemy of the Iridaceae—are being gradually checked, it can be hoped that the cultivation of the many lovely plants of the family may be carried on with increasing success.

* * *

The plant world is so generally at the mercy, more or less, of the animal world that there is a certain satisfaction in contemplating the remarkable Sundews and Bladderworts which reverse the more usual rôles of the eater and eaten. These carnivorous plants, preying with great ferocity and cunning on the inquisitive insects that come within their grasp, are the subject of a specially contributed article by Miss E. L. Stephens, Senior Lecturer in Botany in the University of Cape Town.

* * *

One of the most valuable articles in the early issues of this Journal was that on the Trees of Kirstenbosch. Part III. in which this article appeared is now entirely exhausted, and it has been thought advisable, particularly in the interests of nature study classes, to reprint the whole paper, with key and plates. Slight modifications have been made in the text and the plates have been redrawn.

* * *

If a walk be taken from the Chestnut Avenue to Amaryllis Meet, thence into Window Gorge and *via* Celtis Glade and the Tree Ferns to the Contour Path, thence along the Contour Path across Window, Skeleton, Nursery and Diamond Stream Gorges, and down through the Silver Trees, the majority of the species of our native trees can be seen. Specimens of each species on this route have been labelled by Mr. E. J. Steer and Mrs. Bolus. Incidentally it is also possible to study the habits of the aggressive alien trees, the Cluster Pine, Grey Poplar, Hakea, Eucalyptus and Albizzia, which with the aid of their allies the bush fires are doing so much injury to the native vegetation.

* * *

Mr. C. J. French has contributed to our pages a valuable account of the reptiles of Kirstenbosch, this being an article in the series on the wild fauna of the Gardens which has been appearing in recent issues of the Journal and which has been of so much use to nature students. Mr. French has an exceptional first-hand knowledge of snakes, and those who have seen the uncanny facility with which he tames and handles some of our poisonous species will respect his statements as those of an authority. Fortunately snakes are but little in evidence at Kirstenbosch, and it is possible to live there from one year's end to another without seeing any.

* * *

The Botany Rambles and Nature-Study Courses instituted by the Society and carried on under its auspices for the past three years have developed so successfully as to be now altogether beyond the scope of

the Society. The Cape School Board has, therefore, appointed Miss Starke who will reside at Kirstenbosch and whose whole time will be devoted to the work of conducting rambles and demonstrations. We congratulate the Education Department on the step it has taken, and trust Miss Starke will build solidly on the foundation that has been laid.

The Society hopes during the year to concentrate its efforts on the gardening demonstrations which were started in 1921 and conducted by the Curator of the National Botanic Gardens, Mr. J. W. Mathews. Three or four demonstrations will be given and the dates published in the daily press.

* * *

We deeply regret to record the death of Mr. A. H. Reid, F.R.I.B.A., the well-known Cape Town architect and naturalist. Mr. Reid was a member of the Council of the Botanical Society since its foundation, and always took the greatest interest in the work of Kirstenbosch.

* * *

The death has recently occurred of Mr. H. J. Elwes, an enthusiastic cultivator of South African plants in England. Kirstenbosch is indebted to him for a fine collection of Nerines received last year, Among other names on the obituary list we regret to record those of Professor Sir I. Bayley Balfour, King's Botanist in Scotland and Keeper of the Edinburgh Botanical Gardens: Mr. R. Dümmer, an energetic botanist and plant collector who did useful work on the South African flora and who studied gardening with the present Curator of Kirstenbosch; and Mr. H. C. F. Exner, a prominent Cape Town mountaineer and Mountain Club committeeman, who recently presented the Gardens with an interesting collection of succulents, bulbs and heaths.

* * *

It is with much regret that we bid farewell to Professor D. Thoday, who has been appointed to the Chair of Botany in the University College of North Wales, Bangor, and who leaves South Africa at the end of March. Professor Thoday accepted the Harry Bolus Chair of Botany in the University of Cape Town in 1918, and has devoted himself unsparingly to the work of his Department and of the University. He has also carried out important research work on South African vegetation, on the systematics of *Passerina* and on the anatomy of this and other plants with ericoid leaves. He was a member of the Council of the Botanical Society. We wish him, together with Mrs. Thoday and their four sons, all success and happiness in their new environment.

* * *

The sad death of Mr. Stephen Cavanagh, which robbed the Botanical Society of one of its Life Members, was soon followed by that of his mother, Mrs. Cavanagh. The deceased lady left to Kirstenbosch the sum of £100, to be known as the Cavanagh Donation. This is the first bequest that the Gardens have had made to them.

* * *

We congratulate Mrs. Bolus on her recovery from her unfortunate accident, and we look forward to her complete restoration to strength and activity.

The University of Stellenbosch has honoured itself in bestowing the honorary degree of Sc.D. on Dr. Marloth. Dr. Marloth is a unique figure in botanical science in South Africa. His great work Das Kapland as well as his more recent Flora of South Africa are monuments of brilliant and original observation and investigation, and reveal an amazing knowledge of and a tireless enthusiasm for the plants of this country. We understand that the proofs of the third volume of his Flora are now being read, and we hope that it will not be long before this and the final volume are published.

* * *

We congratulate Mr. Fred Eyles on his recent appointment as Chief Government Botanist of Southern Rhodesia. Mr. Eyles is an enthusiastic collector of plants and has published a valuable list of the Flora of Southern Rhodesia so far as it is at present known: he has contributed many interesting plants, especially orchids, to Kirstenbosch. His new post will give him greatly increased scope for botanical work; we wish him all success in it, and we look forward with confidence to many interesting discoveries in his so imperfectly known botanical domain.

* * *

Among the many plants sent to Kirstenbosch by contributors from various parts of South Africa there are quite frequently species or varieties which are new to science. Some of these are described for the first time in the periodical Annals of the Bolus Herbarium—and this important work will be greatly facilitated when the Herbarium is establised in the Gardens. In a recent issue we find original descriptions of the following novelties, taken from plants grown in Kirstenbosch. *Agapanthus pendulus*, sent by Mr. A. S. Barnett from Lydenburg, Transvaal: a very handsome species with hanging dark blue flowers. *Nerine Frithii*, sent from Riverton by Miss M. Wilman and also by Mr. F. Frith. *Strumaria Watermeyeri* and *Mesembrianthemum Watermeyeri*, both sent from Nieuwoudtville by Mr. E. B. Watermeyer. *Tritonia Mathewsiana*, sent by Mrs. H. M. Wood from Graskop, Pilgrims Rest, and named after the Curator of Kirstenbosch: a beautiful plant which flowers regularly in the Fern Dell by Pan's Pool. *Mesembrianthemum Peacockiae*, sent by Miss W. Peacock, a former gardening student of Kirstenbosch, from near Darling. *Impatiens Duthieae*, a charming waterside trailing balsam, sent by Miss A. V. Duthie from Knysna, and now well established in the Fern Dell. *Watsonia Pillansii*, collected by Mr. N. S. Pillans in the Montagu Pass, and now flowering regularly in two or three places at Kirstenbosch. *Dolichos Peglerae*, of which seeds were sent by Mr. Stayner from the Enkazini Forest in Natal, and which was named in honour of Miss Alice Pegler of Kentani: this grows luxuriantly near the Bath and covers the lower branches of the Ilex with splendid trusses of pink and mauve flowers in late summer. The authority for the above new species is Mrs. F. Bolus.

* * *

The Department of Lands is presenting in Parliament a motion for the relinquishment of a small portion of

Kirstenbosch by the Trustees and its reservation in favour of the University of Cape Town, as a site for the new Bolus Herbarium building. This formality having been settled, it is hoped that the University will lose no time in beginning the erection of the Herbarium which is urgently needed in the interests of the scientific work of the Gardens.

* * *

Advocate R. W. Close, M.L.A., is introducing in the House of Assembly during the present Session a Bill "to make provision for the preservation of natural and historical monuments of the Union, and of objects of aesthetic, historical or scientific value or interest." It is proposed to establish a permanent commission as a corporate body with statutory powers to own or to act as a trustee for such monuments, by which is meant "areas of land having distinctive or beautiful scenery, areas with a distinctive, beautiful or interesting content of flora or fauna, and objects (whether natural or constructed by human agency) of aesthetic, historical or scientific value, or interest, and also waterfalls, caves, Bushman paintings, avenues of trees, old trees and old buildings." The Commission will therefore be on the same lines as the National Trust in Great Britain, which was founded in 1895 and has done so much valuable preservation work. We welcome this movement and hope that it will do its much-needed share in checking the vandalistic destruction of our natural beauties and their exploitation for selfish and anti-national ends.

* * *

The Wild Flower Protection Society is now issuing a monthly publication entitled "Nature Notes" comprising 8 pages of text with illustrations, two loose coloured plates representing protected species of wild flowers, and two outline plates of the same subjects suitable for hand-colouring. The originals of the coloured plates are the work of one of our South African artists, Miss Dorothy Barclay, who has spared no pains in her endeavour to accomplish the difficult task of giving a botanically faithful record of the flowers and, at the same time, a picturesque presentment of the whole with a natural out-of-doors background. Although designed chiefly for school-children from Standard IV. upwards, we believe "Nature Notes" will be heartily welcomed by teachers and many besides who are anxious to know more of our flowers, birds and some of the other creatures in our midst. The publication is edited by Mrs. Bolus and is printed and published by the Specialty Press, Box 21, Wynberg. The annual subscription is 5s.

* * *

Protected wild flowers are still sold in large quantities in the Cape Peninsula. They appear on the Adderley Street market, and they can be seen decorating almost every hotel and restaurant in the False Bay holiday resorts. The vendors are frequently prosecuted and fined: the flowers are not confiscated. *The vendors pay the fines cheerfully and go on selling the rest of the flowers.* It is worth their while to sell protected flowers under this system of low fines and no confiscation. In the country districts, whence flowers are sent to inland centres, there is even less check than in Cape Town. When shall we have the courage to prohibit the sale of wild flowers altogether?

* * *

A new set of regulations in connection with the protection of wild flowers was published in the Official Gazette of the Cape Province on 29th September 1922. The chief alteration is that the regulations now apply uniformly to the whole of the Cape Province. There are still two schedules: one of plants protected against export and sale, the other of plants protected against plucking and damage. A number of additional plants which appeared to be in need of protection have now been included. A noteworthy step has been taken, in response to local demand, in the division of Caledon and the Municipal area of Cradock: with the exception of "everlastings" and "tulp," respectively, all flower picking in these areas is prohibited entirely. If this regulation is enforced Caledon may look forward to a gradual restoration of its former wild flower glories. In the framing of the new regulation the Department has been in close consultation with the Wild Flower Protection Society.

* * *

A devastating bush fire occurred on the eastern slopes of the lower plateau of Table Mountain on the 5th-6th May, destroying practically all the scrub vegetation from Window Buttress to Constantia Nek. Thanks to the strenuous efforts of the Staff and labourers of Kirstenbosch assisted by Forestry students and other voluntary helpers the fire scarcely crossed the Contour Path and the Gardens proper were saved. The women residents gave valuable help in providing and bringing up refreshment to those fighting the flames. Two other fires of limited extent occurred among the Silver Trees later in the same month but were suppressed before any serious damage was done.

* * *

A small collection of living plants from Delville Wood has recently been received at Kirstenbosch. The suggestion was made, in the first place by Mr. Herbert Baker, that it would be appropriate if the National Botanic Gardens were to cultivate some of the native flora of Delville Wood, and that this would appeal strongly to South African sentiment. The Trustees have agreed to set aside an area in the Gardens for the reception of these plants. Arrangements were made through the Delville Wood Committee of the Department of Defence, and the High Commissioner in London. The plants were collected in the Wood by Captain Parker of the Imperial War Graves Commission, and were shipped under the personal care of Sir Owen Philipps. They arrived in excellent condition and are now being propagated in the Nursery. They included Solomon's Seal, Oxlip, species of Veronica and several others. A further consignment is promised later.

As a result of negotiations with the Forest Department, the Trustees of the National Botanic Gardens have been placed in control of the mountain slopes lying immediately behind Kirstenbosch as far as the Wynberg and Cape Town Municipal waterworks boundaries. The map printed on this page shows the position of the ground newly taken over: the total area under the charge of the Trustees being enclosed in thick outlines. The total area now included in "greater Kirstenbosch" is approximately 500 morgen (1,060 acres), of which Kirstenbosch proper with the Klassenbosch annexure includes about 189 morgen, and the new "Upper Kirstenbosch" Nature Reserve about 311 morgen. (Of course on the steep slopes, areas as measured on a horizontal projection are of little meaning.) The Trustees are in consultation with the Wild Flower Protection Society as to the best methods of administering this Nature Reserve in pursuance of the objects for which it was granted, namely "the protection and planting of veld flowers and other indigenous vegetation."

* * *

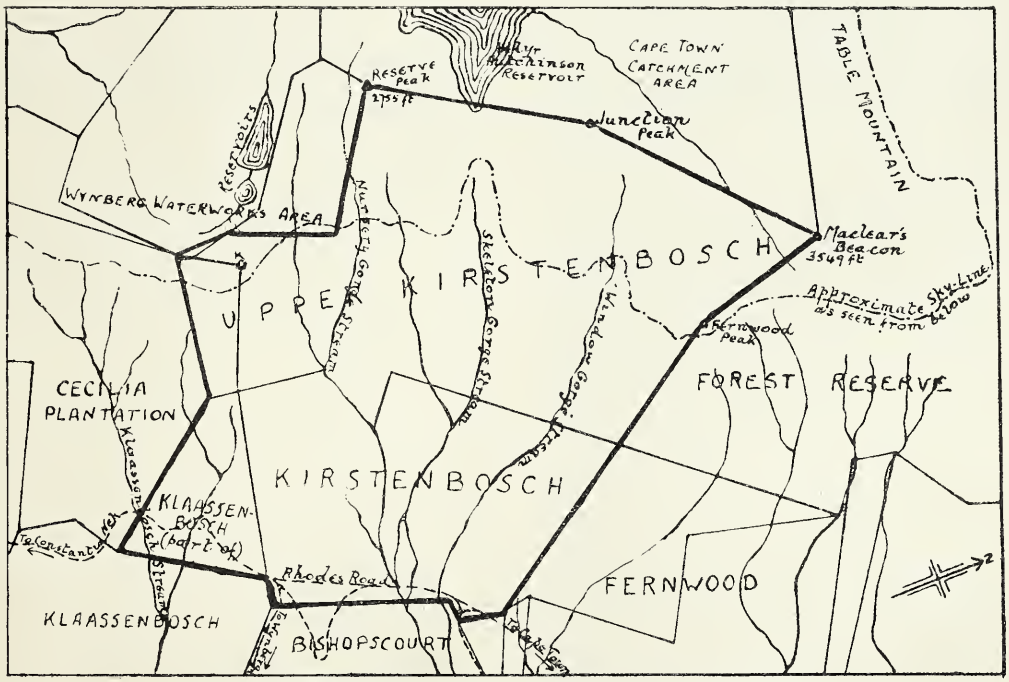
The policy is now being followed of enlarging the European skilled and semi-skilled staff at Kirstenbosch. Construction work is well advanced, and it is now possible to concentrate on gardening proper. There are at present the Curator, Assistant Gardener, three Improver Gardeners and three Student Apprentices. Further enlargement of the white personnel is restricted by the absence of accommodation. The building of the Harold Pearson Memorial Hostel and Curator and Gardeners' cottages is urgently necessary. The present hostel is painfully inadequate and congested. The recommendation of the National Botanic Gardens Advisory Committee (see p. 12) should be carried out without delay, as in some ways conditions are hardly tolerable, and the work and prestige of the Gardens are suffering.

* * *

The Council of the Botanical Society has voted £400 from the Life Members' Fund for the erection of a Tea House on condition that the Trustees raise at least a similar amount from other sources.

* * *

The Specialty Press has recently published an Album entitled "Native Plants at the National Botanic Gardens" which we commend to Members as an attractive memento of Kirstenbosch. It includes twelve plates, from photographs by Mr. A. Elliott, beautifully printed on art paper, representing some of the choice South African plants now growing in the Gardens, and interleaved with descriptive notes. The Album is bound in a white cover tied with brown braid and is packed in a special envelope and boards ready for the post. It makes an excellent gift book, and the price is very moderate. Copies can be obtained from the Secretary, National Botanic Gardens, Kirstenbosch, Newlands for 3s. 9d. each post free. The success of this Album has been such that the Trustees have agreed with the Specialty Press to produce a second series of plates later on in this year.



PLAN OF KIRSTENBOSCH AND THE NEW NATURE RESERVE.

WHAT THE BOTANICAL SOCIETY STANDS FOR.

THE Botanical Society of South Africa was founded in 1913 and will celebrate its tenth birthday this year. As the membership of many of those whose names appear on the list to-day does not go back to the days of its foundation, a short article recalling the reasons for the establishment of the Society and what it stands for may perhaps be of general interest.

The founding of a National Botanic Garden in South Africa had been advocated by prominent botanists for many years before it was sanctioned by Parliament, Kirstenbosch being generally accepted as the most suitable site for the Garden. In the years immediately preceding 1913 various attempts had been made to organise public opinion in support of the proposal. These came to a head on May 16th, 1913, when Sir Lionel Phillips carried to the House of Assembly the following motion, viz.: "That in the opinion of this House the Government should consider the advisability of setting aside a piece of ground at Kirstenbosch for the establishment of a National Botanic Garden." The motion met with general support, among those speaking in its favour being Sir Bisset Berry, Mr. Merriman, Sir Thomas Smartt, Sir Henry Juta and Sir Percy Fitzpatrick, and was accepted by General Botha on behalf of the Government.

In a letter addressed by General Botha to Sir Lionel Phillips shortly afterwards the attitude of the Government to the new project was defined and the extent to which the Government would financially assist the Garden laid down. Whilst promising a measure of Government help, the Prime Minister stipulated that the funds to be given from the public purse must be augmented from other sources. It was primarily to establish an organisation for the raising of funds to augment the Government Grant that the Botanical Society came into being.

That, however, was not the only reason. Right from the start of the Garden the public interest in it was great and it was felt that it would be an invaluable aid to the Garden and those responsible for its progress and development to have an organised body of the public supporting the movement and interested in it. In addition to these considerations, the interest taken by the public of the Union in the wonderful South African flora had grown markedly before 1913 and the time was opportune for the advent of a Society which would foster the study and growth of South African flowers and plants.

It is interesting to recall the terms of the circular calling the meeting at which the Society was founded, viz.:—

> "One of the aims of the Society will be that of rendering assistance in the establishment and development of a National Botanic Garden at Kirstenbosch; but in addition it is hoped to encourage the study of botany and a due appreciation of the wonderful flora of this region . . .
>
> The principal objects of the Garden are:—
>
> 1. Scientific investigation.
> 2. A study of various problems of South African Economic Botany.
> 3. The study and cultivation of South African plants generally.
> 4. The preservation of the South African Flora at present existing in a wild state.
> 5. The laying out of the estate in order that the flora and the natural beauty of the surroundings may be displayed.
>
> In view of the scientific and economic work of the National Botanic Garden State support has been asked and obtained, but it is only reasonable that public assistance should be forthcoming for the aesthetic side of the enterprise. The cultivation and preservation of our flora must appeal to all South Africans. The Botanic Garden at Kirstenbosch should in time rank with, if it does not surpass, the great gardens of the world. . . . It is therefore felt that the movement will be generously supported by a large section of the population."

At a public meeting presided over by the Mayor of Cape Town in the City Hall on June 10th, 1913, the Society was successfully launched, with the late Lord de Villiers as its President. On July 31st of the same year its membership was reported to a meeting of the Society as being 217 and by March of the following year it had grown to 352. At the end of 1922 it stood at 826, a total satisfactory as showing a steady growth but not in other respects when we remember the *national* character of the Society's objects and of the Garden at Kirstenbosch.

The objects of the Society are set forth in its constitution as follows:—

(*a*) To encourage the inhabitants of South Africa to take an active part in the progress and development of the National Botanic Gardens at Kirstenbosch, a part of the Groote Schuur Estate, in the Cape Province, and to induce them to appreciate their responsibilities therein.

(*b*) To augment the Government Grants towards developing, improving, and maintaining fully equipped botanical gardens, laboratories, experimental gardens, etc., at Kirstenbosch.

(*c*) To organise shows at which may be displayed the results of botanical experiments or cultural skill in improving the different varieties of South African flora.

(*d*) To enlighten and instruct the members on botanical subjects by means of rambles, meetings, lectures, and conferences, and by the distribution of literature.

What can the Society claim to have done towards achieving its objects?

(*a*) It has succeeded in actively interesting in Kirstenbosch its 826 members and many more who have not joined the Society. These are not merely inhabitants of the Cape Peninsula and its neighbourhood but they reside in all parts of the Union. The large annual contribution of plants to Kirstenbosch is proof of this: they have come from every portion of Africa south of the Zambesi.

(*b*) It has materially augmented the income of the Garden, without which augmentation Kirstenbosch could not have made the progress it has. All surplus revenue, after deducting the expenses of the Society, has been handed over to the Trustees of the Garden. The sums so available have been: 1913, £212 13s. 1d.; 1914, £217 6s.; 1915, £252 12s.; 1916, £259 8s. 8d.; 1917, £233 7s. 5d.; 1918, £299 12s. 6d.; 1919, £290 19s. 3d.; 1920, £373 8s.; 1921, £491 7s. 5d.; 1922, £460 10s. 7d. In addition to the above it may be explained that the subscriptions of life members (£25) are put to a special fund which can only be spent on specific works of development in Kirstenbosch. From this fund grants to a total of £870 have been made and at the end of last year there was a balance of £655 still available. The rockery in the Dell, the pond in the Great Lawn, and a part of the Aloe Kopje are the result of the provision of money from this source.

(*c*) The interest taken in the South African flora is greater to-day than ever before and, while acknowledging the large share that other organisations have had in promoting this, the Botanical Society has done much to bring it about.

(*d*) Thanks to the devoted efforts of Mrs. Bolus' Kirstenbosch has been used by the Society to educate young people in the love of nature and of the South African flora by means of rambles, lectures, etc.

(*e*) The Society's Journal has spread knowledge and focussed interest in botanical subjects. And lastly

(*f*) The Society has furnished an invaluable moral support to those in charge of the National Botanic Gardens. The following words of the late Dr. Pearson, the first Hon. Director, uttered in 1914 are as true to-day as when they were spoken, viz:—

> "Finally may I say a word of appreciation of the great benefit derived by the National Botanic Gardens from the support of the Botanical Society. Great as has been the financial assistance given by the Society at a time when additional funds are urgently required, I think that the moral support furnished by the existence of this Society is of at least equal importance. The Gardens have come into existence in response to a popular demand. Their progress and development must always be more or less dependent upon the degree in which the public maintains its interest in them. The concentration of effort in this direction represented by the Society is therefore a factor of the deepest significance. The greater the activity of the Society the more rapidly will the Gardens justify their claim to the title which they hold."

Balgay,
Wynberg.

W. DUNCAN BAXTER.

THE NATIVE TREES AND TREE-SHRUBS OF KIRSTENBOSCH.

THE trees and arborescent shrubs native to Kirstenbosch group themselves into those of the open mountain-slopes and those of the gorges. Not that there is any hard and fast line between the two divisions, for there are some that wander from their more natural folds in the ravines to mingle with those on the sunnier slopes and there assume a more shrub-like habit. With the exception of the silver-tree, the rule is, therefore, that all which deserve the title of trees are found in or near the ravines.

Nor it it easy in practice to make a nice distinction between large shrubs and trees. For there is every gradation between the typical *shrub*—say, of not more than 20 feet in height, which branches from the base, having no one stem strongly predominating over the others, and the typical *tree*, usually more than 20 feet in height, which branches well above the base and has one definite main stem or trunk.

Of the trees on the mountain-sides and lower foothills, the silver-tree or witte-boom (which being translated into Greek is *Leucadendron*), stands first in our affections. We who live here feel a thrill of pride at the mention of the silver-tree, for are they not almost confined to the Cape Peninsula, and do we not share their beautiful home? The lady, who said emphatically of the Cape about a hundred years ago: "There are *no trees*. The silver-tree is the loftiest indigenous plant which I saw," was no doubt thinking of the more usual shade-giving trees of Europe and elsewhere, and had not become reconciled to the idea of one that was actually light-giving instead. It is wonderfully beautiful, when the breeze sweeps over a branch, to watch the light playing among the leaves as each one successively responds to the touch of the wind. Dr. Marloth, in his "Flora of South Africa" (Vol. I, 145), explains how this brilliant effect is produced.

Silver-trees are first met on Wynberg Hill, and extend from there all along the ridge and its slopes into Kirstenbosch, till they come to a dead stop at the gum plantation. Those growing on the slope above the Nursery have been delivered from the clutches of their arch-enemy, the cluster-pine, but will no doubt continue to bear the marks of the struggle to their dying day. There are, however, many young trees coming on, and the old associations, killed by the pines, are reforming. For although silver-trees often grow in

masses, yet there is always a dense undergrowth right up to their very boles. Keurtjes, both the large rose-pink and the smaller pink and cream one (*Podalyria calyptrata* and *P. argentea*), the tall, royal-blue *Aristea* (*A. capitata*) and the lower, pale blue one (*A. spiralis*); the large, deep pink *Watsonia* with drooping flowers (*W. rosea*); belladonnas; bracken; blue *Scabiosa*; yellow *Senecio* (*S. lineatus*); wild irises (*Moraea ramosa* and *M. glaucopis*); small, sweet-smelling evening-flowers (*Silene clandestina* and *S. Burchellii*); fragrant, wild buchu (*Diosma vulgaris*); orchids (*Satyrium lupulinum* and *S. odorum*); April fool (*Haemanthus coccineus*); zurings (*Oxalis bifida, O. livida, O. polyphylla*, etc.); grasses (*Andropogon hirta, Ehrharta Rehmannii*, etc.); blue *Salvia* (*S. africana* and *S. paniculata*)—these and many others form a tangle of varied charm and beauty.

July is the sweetest time for silver-trees, when the tips of the branches are putting out the new leaves, which surround the young flower-heads, and the silver gleams with a light as of mingled sun and moon—so bright and yet so soft it is. Then you may see the long-tailed sugar-bird (*Promerops caffer*) aloft on the tallest tree, his tail gently waving in the breeze as he "stands up and takes the morning." Below in the protea bush (*P. incompta*), with its richly-honied flowers, is his mate, and he will come fluttering down to her presently, making a great display of that fine tail of his.

Besides those on Silver-tree Ridge, there is a picturesque, scattered group all among the common mountain heather (*Erica hirtiflora*) on the northern side of Skeleton Gorge. They have a cloistral appearance as compared with their brothers and sisters in more exposed situations, and have been called "the nuns going to their chapel in the rocks above." Another company grows on the knoll below the wild aloes.

On the slopes, and especially on those between Skeleton Gorge and the trolley-track, are the familiar blobs of grey, each of which means a waaboom or wagon-tree (*Protea grandiflora*). They are indistinct on a bright sunny morning, sometimes disappearing entirely, but always conspicuous in the afternoon lights. The flower-heads are large and wide open and have creamy-coloured bracts. It is interesting to note the position of the leaves with regard to the light. Instead of having their flat surface at right angles to the rays of the sun, by means of a half-twist at the base they assume a position of edge-on, so that the rays strike their flat surface obliquely. There is, therefore, no defined greener upper and paler under surface as in the dorsi-ventral or bifacial type of leaf. Teachers will find this a convenient example of the isobilateral type.

The kreupelboom (*Leucospermum conocarpum*) is not so easily seen on the slopes from a distance as the waaboom, nor does it occur so frequently. When each of the younger branches is tipped with its golden bristling ball of flowers it is indeed a handsome sight. The leaves are thick in texture and the sturdy branches numerous and well covered with overlapping leaves, and if one cannot rest *beneath* the shade of a kreupelboom one can do so in its shadow. For shelter it is one of the best, and when one's spirits are down and the wind blows cold, to get on the leeside of a kreupelboom is to—

> "quite forget
> What thou among the leaves hast never known
> The weariness, the fever and the fret
> Here, where men sit and hear each other groan;
> Where palsy shakes a few, sad, last grey hairs,
> Where youth grows pale and spectre-thin, and dies;
> Where but to think is to be full of sorrow
> And leaden-eyed despairs;
> Where beauty cannot keep her lustrous eyes,
> Or new Love pine at them beyond to-morrow;

and to say with Wordsworth:—

> "Ye blessed creatures, I have heard the call
> Ye to each other make; I see
> The heavens laugh with you in your jubilee;
> My heart is at your festival,
> My head hath its coronal,
> The fulness of your bliss, I feel—I feel it all."

Bergsapree (*Widdringtonia cupressoides*) occurs sparingly on the slopes. A good example may be seen on the Contour Path, just as it emerges from the dense growth of Window Gorge and the view opens out before one. This and the yellow-wood belong to the large group of "conebearers" (Coniferae). Economically, the Coniferae are valuable, "furnishing a large proportion of our timber, as well as resins, tars, turpentines, etc." Their distribution, too, is interesting. In the tropical forests they are almost entirely absent except at high altitudes, while in the Northern and Southern temperate zones they form important constituent parts in the forest vegetation. In the north there are the larches, firs, yews, pines, junipers, cedars, cypresses, the gigantic *Sequoia* and others, while among the southern conifers we have the Kauri or Cowrie pine, the monkey-puzzle tree, Norfolk Island Pine, *Podocarpus* and *Widdringtonia*. In South Africa there are about three species of each of the last two genera, of which two are native to Kirstenbosch.

Widdringtonia is usually classed with the pines in the Order Pinaceae, notwithstanding the fact that their small closely-appressed leaves look very different from the "pine-needles" and the two pairs of scales which fit together (valvate) to form the female cone are a contrast to the numerous spirally arranged over-lapping (imbricate) ones of the pine. They are alike, however, in the fact that each scale bears more than one seed, and that the male and female cones are on the same plant (monoecious). The male cones are very inconspicuous, the stamens that form them being similar to the foliage-leaves. The pollen is distributed by wind, as are also the winged seeds.

The Kirstenbosch yellow-wood is the oprecht geelhout, or rough-barked or broad-leaved yellow-wood (*Podocarpus latifolius*). It belongs to the same Order as the yew and the Gingko, Taxaceae, and has the male and female flowers or cones on different plants (dioecious). The former is composed of a number of coloured over-lapping stamens, each with two pollen-bags, and the latter is not a hard, dry cone at all. It is usually made up of half a dozen scales, of which *one* or *two* project above the rest, each bearing one seed, while the four or five sterile scales normally become fleshy and form



Plate I. : Native Trees and Tree-Shrubs of Kirstenbosch.



Plate II. : Native Trees and Tree-Shrubs of Kirstenbosch.

the birds' " bonne bouche " and the botanists' *podo*, or " receptacle," on which the *carpus*, or fruit, stands. Excellent pictures and drawings of our two conifers are given in Dr. Marloth's " Flora of South Africa " (Vol. I., Plate 17, and Figs. 65 and 67).

There are several moderately good specimens of *Podocarpus* along the Contour Path. Perhaps the one that can be seen to the best advantage is near the upper end of the path that breaks off from the Contour Path and leads down the northern side of the Skeleton Gorge, joining the Window Gorge path at the belladonnas. It is a female plant.

But the yellow-wood has brought us to the three gorges—with their trees like rivers gently flowing down and gaining breadth as they go. Each has its own special charm—Nursery Gorge, its path winding up in the green and its fine bastion of rock, casting varying shadows all through the day; Skeleton, with its deep northern side, where leucadendrons splash the emerald with gold in winter, and the leaves of the hard pear glitter in the sun and the olive branches are like white lines in the dark green; and Window has its red rock with the trees all round it and up against it, and its queenly Cunonias.

There is only one species of *Cunonia* in South Africa, *C. capensis*, found in moist, woody places throughout the Cape Province. Many other species occur in New Caledonia. Dr. Marloth * says it makes beautiful furniture and that it has been used in the little English Church at De Doorns for that purpose. The plant was so named by Linnaeus, the generic name being " in honour of John C. Cuno, of Amsterdam, who described his own garden in Dutch, in 1750." Among the Peninsular trees it is the only one that reaches the summit of Table Mountain, though it is rather stunted when it does get there. It branches very regularly, sending off two opposite shoots on each side of the main shoot; and when it has fair play it forms an ample, rounded, rich-looking tree, with large, glossy, gracefully-spreading leaves, and attains a height of 50 feet. The leaf-stalks and younger portions of the stem are usually tinted with red, which no doubt partly accounts for one half of the name—rooiels, or red alder. The leaves are usually composed of three pairs of leaflets and an odd terminal one, and the two united stipules afford an excellent example of how effectually young buds may be protected. They are often called " mustard-spoons " by children, who love to open them and look for the roughness at the base, where the " butter " is made. The cream-coloured flowers come in March and April and are pleasantly scented. They are small and very numerous, with ten projecting stamens, and are arranged in " bottle-brushes " up to eight inches long—quite the handsomest inflorescence of all the trees in Kirstenbosch, while that of the Keurboom (*Virgilia capensis*) is the sweetest.

As in the case of *Cunonia*, there is only one species of *Virgilia*, found along river- or stream-banks in various parts of South Africa. " Keur " means choice, and apparently the original Dutch name has never been translated into English. It seems almost untranslatable. Its botanical name, in honour of the poet Virgil, was given by the great Lamarck, " the founder of evolution "* and " more than a systematic biologist of the first order." His countrymen called him the French Linné. He was born at Bazentin-le-Petit, quite near Longueval and Delville Wood. Did any of our South Africans know that through the sweet keurboom and Lamarck the land of their birth was linked with that of their death? Did they know that he who gave our keur its beautiful name was also a soldier; how as a lad of 17 " he bought himself a wretched horse for want of means to buy a better one and rode across the country to join the French army then campaigning in Germany "; how on the break of day on the 16th July, 1761, " when the Colonel rode along the front of his corps the first man to meet his gaze was the new recruit, who had placed himself in the front rank of a company of Grenadiers "; how he distinguished himself that day so that he was promoted " on the field to the rank of officer." He died old and blind, and his remains " were thrown into a trench apparently situated apart from the other graves," so that " the exact site of the grave is and for ever will be unknown," as will that of many of our bravest.

Haller, after whom Linnaeus named our oudehout or witolijf (*Halleria lucida*) was a Swiss botanist and a contemporary of Lamarck, who wrote that, while botany was languishing in France, " Linné in Sweden, Dilwillen in England, Haller in Switzerland, Jacquin in Austria, etc., have immortalized themselves by their own works, vastly extending the limit of our knowledge in this interesting part of natural history." The specific name, *lucida*, refers to the glossy appearance of the leaves. It belongs to the Order Scrophulariaceae. *Halleria* is quite common at Kirstenbosch and is, perhaps, the daintiest of our trees—the young twigs making long, light sprays of delicately-veined leaves, tapering into " drip-tips." The flowers are a dull red, about an inch long, and much larger than those of any other tree. Sometimes they occur singly, or a few together, in the axils of the leaves and sometimes in clusters on the bark of the older branches or trunk. The berries turn a deep purple and, according to the traveller Burchell, were much eaten by the Hottentots. Now, the red-winged spreeuw or rooivlerk (*Amydrus morio*) probably knows more of their flavour than any other consumer in Kirstenbosch.

Zwartbast, or black-bark (*Royena lucida*) belongs to the same order (*Ebenaceae*) as the famous Ceylon ebony tree. It is to be seen all over the Gardens, sometimes as a low, sometimes as a tall shrub, but in the gorges it becomes a tree attaining 30-40 feet in height. It has rather small, egg-shaped, highly polished leaves and solitary (*i.e.*, singly in the axil of the leaves) cream-coloured flowers, less than half an inch long. In the fruiting stage, however, the calyx increases in size up to an inch in length, like that of the " Cape gooseberry," and, becoming inflated, encloses the ripening

*" Common Names of Plants," p. 5.

*A. S. Packard, " Lamarck," p. 1.

fleshy fruit. This characteristic has given the zwartbast the name of " African bladdernut."

Of the *Celastraceae*, the Order to which the well-known spindle-tree of Europe belongs we have seven* representatives at Kirstenbosch, comprised under the five genera *Gymnosporia, Elaeodendron, Hartogia, Cassine* and *Pterocelastrus*. The zybast, or silk-bark (*Gymnosporia acuminata*) seems to be the largest tree in this group. It has dark green leaves, rather thin in texture, tapering into a " drip-tip," and always shows silky threads when the leaves are broken cross-wise. Miss Duthie, who examined the leaves, informs me that " the silkiness of the leaf is due to an elastic gum present in secretory sacs which are associated for the most part with the vascular bundles. The threads dissolve completely in xylol, benzol, etc., and are, of course, entirely different from those of some monocotyledonous leaves where they represent the spiral thickenings of vessels." The latter may be seen well in the leaves of *Brunsvigia gigantea*, the candelabra-lily.

Pterocelastrus tricuspidatus is one of the trees or tree-shrubs known as kersenhout, or cherry-wood, and is interesting as being the possible origin of the name " Kersianbosch," as it appears in the early documents and, later, Kirstenbosch. But, according to Pappe, the wild peach, or spekhout (*Kiggelaria africana*) was also called kersenhout, probably because the seeds, displayed in the fruit as it splits open, are a bright red. It is doubtful, therefore, from which of the two the name has been derived.

By far the largest of the four olives is *Olea laurifolia*, the black ironwood, of which there are a number of good specimens. On the Contour Path, on the northern side of the Window Gorge, just at the point where, after two zigzags, the Path continues in a northerly direction past some Hottentot cherry trees, and in a southerly towards the trolley track, stands perhaps the finest of the black ironwoods, with a trunk girth of over 9 feet. From a mighty anchorage of partially visible roots the straight trunk rears itself and towers over the neighbouring oaks with its huge branches. What a magnificent view could be opened up just here of the distant flats, mountains and bay, with this king of Kirstenbosch, freed from exotic growth, exposed in all its strength and glory against the blue of the sky !

Amid the all-pervading beauty of Kirstenbosch there are yet spots, bearing some special charm, which arrest the attention and call for a more particular designation. One of these is the Celtis Glade in Window Gorge, a few paces above the second crossing of the stream. Up through the trees in the background may be seen the great rocks and moss-covered boulders and a storm-beaten old waterboom. On the right is the slope of the Aloe Knoll, with a trickling stream at its base, and at the head of the stream a group of tree-ferns, bordered by a soft fern, *Hypolepis*. Beyond these, and making a wide semicircle around them, are a rooiels, an oudehout, a wild peach and, with a narrow path between, a rambling katdoorn. A little below and detached, as the " captain jewel of the carcanet " is the Camdeboo stinkwood (*Celtis Kraussiana*), the only specimen known within our limits.* It has been maltreated in the past, the trunk having been injured and the wide-spreading crown starved for want of light, and deprived of space for expansion, by the overcrowding oaks. As it is, the girth of the trunk is 10 feet 4 inches and its height 12 feet 4 inches. A good figure showing the monoecious unisexual flowers and the fruit is given in Dr. Marloth's " Flora of South Africa " (Vol. I., Plate 23), and descriptive notes on page 133.

The last tree to notice is our only " laurel," the stinkwood (*Ocotea bullata*), near the lower end of the Skeleton Gorge path, but below its level and so easily overlooked. It is the largest specimen known in Kirstenbosch and one of the very few of any size that have survived. Dr. Marloth (l.c. Plate 62, pp. 229, 230) gives a picture of the flowers and fruit, and some interesting notes on its distribution, and the *bullae* or bosses on the leaves.

* * *

The following Key, founded mainly on leaf-characters, will serve as a ready means of identifying Kirstenbosch trees; and the determinations thus obtained can be verified by the Plates.

KEY TO THE NATIVE TREES AND TREE-SHRUBS OF KIRSTENBOSCH.

Leaves less than $\frac{1}{4}$ inch long
Widdringtonia cupressoides, Endl. *Berg Sapree* (II. 18).
Leaves more than $\frac{1}{4}$ inch long
Arranged in whorls
Whorls of 6 to 8 leaves
Brabeium stellatifolium, L. *Wild Almond* (II. 19).
Whorls of 2 leaves
Compound .. **Cunonia capensis, L.** *Rooiels* (I. 16).
Simple
Stipulate
Pubescent **Plectronia Mundtii,** Pappe. *Klipels* (II. 8).
Glabrous .. **Plectronia ventosa, L.** *Schaapendrolletjes* (II. 2).
Exstipulate
Entire
Under-surface with hairy pits near midrib **Olea foveolata, E. Mey.** *Bastard Ironwood* (II. 7).
Under-surface scurfy : lanceolate **Olea verrucosa, Link.** *Wild Olive* (II. 9).
Not as above
Young axes whitish ; leaves usually glossy **Olinia cymosa,** Thunb. *Hard Pear* (I. 12).
Young axes grey or green ; leaves usually dull

Lauridia reticulata, E. and Z. probably occurs in the ravines, but so far we have not succeeded in finding it.

*Another specimen occurs in Skeleton Gorge above the Contour Path, *i.e.* in Upper Kirstenbosch Nature Reserve.

Leaves ovate or lanceolate-ovate, acute **Olea laurifolia,** Lam. *Black Ironwood* (II. 3).
Leaves broadly ovate or oval, obtuse
Margins flat; dark green
Cassine Maurocenia, L. *Hottentot Cherry* (I. 13).
Margins slightly revolute; not dark green
Olea capensis, L. *Ironwood* (II. 11).
Serrate or irregularly toothed
Petioles and veins with shaggy brown hairs .. **Curtisia faginea,** Ait. *Assegaiwood* (I. 17).
Petioles and veins glabrous
Lanceolate **Hartogia capensis,** Thunb. *Lepelhout* (I. 7).
Ovate
Rather obtuse, rigidly serrate, leathery
Elaeodendron Kraussiana, Bernh. *Lepelhout* (I. 4).
Acuminate, minutely serrate, thin in texture **Halleria lucida,** L. *Oudehout* (II. 12).

Arranged in spirals
Compound
Pinnately compound
Virgilia capensis, Lam. *Keurboom* (I. 15).
Palmately compound
Leaflets three **Rhus tomentosa,** L. *Krentebos* (II. 6).
Leaflets more than three
Cussonia thyrsiflora, Thunb.
Simple
Sessile
Glabrous
Grey-green, more than ½ inch wide
Protea grandiflora, Thunb. *Waaboom* (II. 10).
Dark green, about ½ inch wide or less
Podocarpus latifolius, R.Br. *Real Yellowwood* (II. 17).
Hairy or silky
Entire .. **Leucadendron argenteum,** R.Br. *Silver Tree* (II. 14).
Toothed at apex
Leucospermum conocarpum, R. Br. *Kreupelboom* (II. 13).
Petiolate
Entire
Axils with hooked spines
Scutia indica, Brogn.. *Katdoorn* (I. 6).
Without spines
About ½ inch long, margins recurved
Phylica buxifolia, L. (I. 10).
More than ½ inch long, margins flat
Swellings towards the base of midrib
Ocotea bullata, E. Mey. *Stinkwood* (II. 15).
No swellings
Hairy on the under-surface
Dark-green and shining
Royena lucida, Thunb. *Zwartbast* (II. 4).
Pale green or drab
Tarchonanthus camphoratus, L. *Camphorwood* (II. 5).
Glabrous on the under-surface
Primary nerves more than 12 pairs
Myrsine melanophloeos, R. Br. *Beukenhout* (II. 1).
Primary nerves less than 10 pairs
Midrib raised on the upper surface
Fruit smooth
Gymnosporia laurina, Thunb. (I. 11).
Fruit with appendages
Pterocelastrus tricuspidatus, Sond. *Kersenhout* (I. 14).
Midrib sunk on upper surface
Acutely acuminate
Ilex capensis, Sond. & Harv. *Waterboom* (I. 8)
More or less obtuse
Apodytes dimidiata, E. Mey. *Witte Peer* (II. 20).
Serrate or irregularly dentate
Axils with spines
Obtuse; spines often bearing leaves
Gymnosporia buxifolia, L. *Pendoorn* (I. 5).
Acuminate; spines not bearing leaves
Scolopia Mundtii, Arn. *Klipdoorn* (I. 2).
Axils without spines
Leaves pinnately veined
Blades when broken across showing silky threads
Gymnosporia acuminata, L. *Zijbast* (I. 9).
Blade not as above
Oblong or linear-oblong or linear, petiole hairy **Kiggelaria africana,** L. *Kersenhout, Wild Peach* (I. 1).
Ovate
Scrambling shrub
Grewia occidentalis, L. *Kruisbesje* (I. 3)
Large trees
Acutely acuminate, first two primary nerves starting from base of leaf
Celtis Kraussiana, Bernh. *Camdeboo Stinkwood* (II. 16).
Acute, first two primary nerves not as above
Scolopia Mundtii, Arn. *Klipdoorn* (I. 2).
Leaves palmately veined
Cussonia thyrsiflora, Thunb

Bolus Herbarium, University of Cape Town.
L. Bolus.

THE NATIONAL BOTANIC GARDENS ADVISORY COMMITTEE.

IT is well known to Members of the Botanical Society that Kirstenbosch has never been able to command adequate funds. The Society itself has in the past responded nobly to the appeal for money to carry on the work of the Gardens, and the constantly growing membership is witness to the widespread interest in the Gardens and appreciation of their national importance. Numerous private donations have also been made. There has been a strong and growing feeling among those interested in Kirstenbosch that the support accorded by the Union Government has been unworthy of the high national value of the Gardens and of the generous voluntary assistance given by private individuals. The reason for this neglect need not be analysed at the present moment. It was felt, however, both by the Department of the Interior and the Trustees, that the position demanded investigation, and that the advice of experts on matters concerning the Gardens would be valuable both to the Government and the Trustees. A *National Botanic Gardens Advisory Committee* was therefore appointed in September, 1921, and mutually approved by the Department of the Interior and the Trustees. Dr. Peringuey, Director of the South African Museum, nominated by the Government, was elected Chairman; the other members were Mrs. Bolus, Curator of the Bolus Herbarium; Mr. F. E. Cartwright, late joint Hon. Director of the Gardens; Professor Compton, Hon. Director of the Gardens; Dr. C. E. Moss, Professor of Botany in the University of the Witwatersrand; and Professor Thoday, Professor of Botany in the University of Cape Town.

* * *

This Committee met repeatedly and made an exhaustive investigation which they embodied in their Report*, issued on 5th July, 1922. The following is the Chairman's covering letter, addressed to the Hon. the Minister for the Interior and to the Chairman of the Trustees of the National Botanic Gardens:—

SIR,—The Advisory Committee appointed by the Department of the Interior and the Trustees of the National Botanic Gardens in September, 1921, was instructed to bring a Report to be presented to both the Department and the Trustees.

The Committee was instructed, *inter alia*, to express their consideration of:—

(*a*) The scope and work of the National Botanic Gardens.
(*b*) The buildings and equipment and staff necessary for the work proposed.
(*c*) The cost of development and maintenance.
(*d*) The broad features of the lay-out.

In accordance with these instructions the appointed members met and discussed all the points above enumerated. They have come to the following conclusions, which I now have the honour briefly to recapitulate: all the detailed information is to be found in the accompanying Introduction and Detailed Statement.

The opinion of the Committee is resumed here as follows:—

The improvements suggested and the modifications to be made are entirely dependent on the Parliamentary Vote for the upkeep and progress of the Gardens. The Grant ensuring the existence of this national establishment is quite inadequate even for present maintenance. The Committee therefore suggest that the annual grant be increased from £1,500 to £3,500 for the next financial year, plus a progressive yearly increment of £500 until the amount of £10,000 per annum be reached in fourteen years time.

In addition a sum of £4,000 is needed at once for urgently necessary buildings.

The Government and the Trustees will gather from the attached Report that unless this annual income and capital grant be forthcoming the recommendations and suggestions here appended could not be carried out.

The Committee are most anxious to convince both the Government and the Trustees that the points on which they report have been most carefully considered in all their bearings, and have been arrived at unanimously.

I have the honour to be,
Sir,
Your obedient servant,
(Signed) L. PERINGUEY,
Chairman.

Cape Town,
5th July, 1922.

* * *

In the body of the Report is a comprehensive account of the aims and functions of the Gardens, what they have accomplished in the past and their programme for the future; together with estimates, list of necessary staff, buildings and equipment, comparisons with other botanic gardens, and so on. The Committee had the advantage of receiving most interesting reports and memoranda from the Directors of other botanic gardens —Kew, Brooklyn, Sydney, Singapore—as well as important statmeents from Mr. J. Burtt-Davy and Mr. J. W. Mathews, the Curator of Kirstenbosch. The whole Report is a most valuable document, and coming as it does from a recognisedly distinguished and disinterested source it may be regarded as embodying the soundest expert opinion on the many problems connected with the National Botanic Gardens.

* * *

* A few copies of this Report are available *on loan* to Members of the Botanical Society, and application should be made to the Secretary, National Botanic Gardens, Kirstenbosch, Newlands, C.P.

On the 18th July, 1922, the Hon. Patrick Duncan, Minister for the Interior, received a deputation of representatives of the Trustees of the National Botanic Gardens, the Botanical Society and the National Botanic Gardens Advisory Committee. The following is a report of the proceedings :—

Mr. Duncan Baxter, who introduced the deputation, referred to the recently issued Report of the National Botanic Gardens Advisory Committee, which had been presented to the Minister of the Interior and to the Trustees. The idea of the Committee originated when the Gardens were started, it being intended to appoint a Committee to advise on the general lay-out of Kirstenbosch. The war intervened and the arrangements fell through. Last year, however, it was decided by the Department of the Interior in consultation with the Trustees, to appoint an Advisory Committee of South African experts ; the personnel of this Committee was approved by both the Department and the Trustees, and Dr. Peringuey, nominated by the Department, became Chairman. Mr. Baxter expressed regret that Dr. Peringuey was prevented by illness from being present. Professor Moss and Professor Thoday were also unavoidably absent.

The Advisory Committee had gone carefully into the whole subject and had now reported. It was not necessary to go into the detailed recommendations and scheme of development which the Committee had put forward. The matter amounted to this, as stated in the Chairman's covering letter, that to carry on the Gardens properly required increased capital for buildings and increased income for upkeep and development.

Kirstenbosch had never received adequate assistance from the Union Government. It had been trying to do a man's work on a child's ration. Valuable work had been done in the economic, the aesthetic and the educational fields. No encouragement had been given to economic work, though the experiments on Buchu and other plants had already shown how valuable such work was ; and there was no intention of overlapping the work of other institutions in this respect. Educational work was being done by devoted voluntary effort, and the Provincial Department had undertaken to recognise this by the appointment of a resident teacher. The expensive work of development (roads, drainage and so on), which should have been met by capital grants had had to be financed from income or from voluntary contributions.

The Committee estimated that £4,000 was required at once for urgently necessary buildings. This included Offices ; the proposal being to build a house for the Curator and to convert the present house into offices which should be a centre of the Gardens' work : Stables, Nursery Buildings, and two Foremen's Cottages. The Harold Pearson Memorial Hostel was still unbuilt ; there was about £1,300 in hand from voluntary subscriptions, and the Government had promised £ for £ for this purpose two years ago, but the scheme had to be dropped temporarily owing to the high cost of building.

With regard to annual income the Committee had reported that a grant of £3,500 from the Union Government was necessary for next year. The matter was an urgent and important one. We were at the parting of the ways ; it had to be decided whether the Gardens were to progress as they should or whether they were to degenerate and past efforts to be wasted. There was no question that Kirstenbosch was the best site in the Union. It lay near the centre of one of the richest floral areas in the world ; Mr. Baxter quoted expert opinion on the subject. No other site had equal claims. The possible difficulties with regard to Karroo plants were being met by the adoption of the sub-station at Whitehill. It was necessary for the Government to take a much more sympathetic view of what was a great national institution and help it financially to develop in a worthy manner.

Sir James Rose-Innes then spoke and laid stress on the national character of the Gardens, and the fact that they had all through received great support from the South African public in the constant stream of contributions of plants, through the Botanical Society which had members all over the Union, and by private subscriptions to the Gardens funds. The public had contributed more than £4,000 to the support of the Gardens ; some of this had been spent on such work as construction in the Fern Dell, water supply, etc., the rest being added to the general funds. (The other sources of revenue being the Cape Town Municipality £500 per annum, the Cape Divisional Council £100 per annum and sales of produce, the last being a diminishing quantity.) Most of the subscriptions for this essential national work had been contributed by Cape Peninsula people. It was now the duty of the Union Government to support the Gardens better. The Gardens had not been adequately or fairly treated in the past. He saw the way in which money was spent lavishly on other institutions such as the National Zoological Gardens and the Union Buildings Gardens at Pretoria ; he did not say anything against this, on the contrary he congratulated those institutions and wished them luck. But Kirstenbosch should be treated at least as well as they are.

As it was the Gardens were wretchedly equipped. There were no scientific facilities and almost no scientific staff. There were no proper offices even, the Secretary having to share the Director's private study, and the Curator having to use a damp and tumble-down hovel The stables were inadequate and defective, and so were the nursery buildings. The Director's house was too small. All sorts of expenditure on development and permanent works had had to be financed from income to the detriment of maintenance and gardening work. Voluntary help had been forthcoming in many directions. It had only been possible to run the Hostel, on which so much gardening work depended, through a committee of ladies who paid its losses. Mrs. Bolus had done a vast amount of voluntary work in using the Gardens for educational purposes and in introducing slum children to something better than walls and pavements. The public and individuals had done so much for and through Kirstenbosch that it was now incumbent on the Government to provide adequate funds, as set out

in the Report of the Advisory Committee, to carry on the great work that had been initiated.

THE MINISTER FOR THE INTERIOR, replying, said that at the present time it was exceedingly difficult to find money for any purpose, and that on all sides it was necessary to cut down expenditure. At the same time he was in sympathy with what had been said and with the objects of the Gardens. While he could make no definite promise as to what sums would be forthcoming, he would undertake to do all that he could to help the finances of the Gardens, both through a capital grant and through an increase in the annual income. He agreed that it would be a great pity if the Gardens were to go back in any way, and he would do his best to prevent this happening.

After remarks by the Mayor of Cape Town and Mrs. Burton the members of the deputation thanked the Minister and withdrew.

Unfortunately the Government did not appear to be in a position to carry out the assurances given by the Minister. A letter was received later stating that no additional grant could be put upon the Estimates for the coming financial year. The Trustees accepted this statement in view of the condition of the national finances, acutely disappointing as it was to the members of the Committee and to all concerned. The Report of the Committee, however, is still before the Minister, who has given definite expressions of sympathy with the Gardens and explicit promises to do all he can to help their funds, and there we must leave it in confidence that as soon as the finances of the Union improve, Kirstenbosch will receive the recognition and assistance that are her due.

R. H. COMPTON.

Kirstenbosch.

PROGRESS AT KIRSTENBOSCH.

THE following summary of the principal work done in the Gardens, from April 1st to December 31st, 1922, is recorded for the information of members of the Society who are unable to keep themselves acquainted with the progress by frequent visits to Kirstenbosch.

The collection and sowing of seeds, and propagation by cuttings, of scarce or showy succulents has been carried on regularly in the Nursery. Good batches of *Rochea coccinea, R. perfoliata, R. versicolor* and *R. jasminea*, numerous fleshy Mesembrianthemums, including *M. nobile, M. calcareum, M. Tugwelliae*, etc., Stapelias and their allies, etc., have resulted. Specimen pots of Mesembrianthemums have been selected for exhibition purposes, and the remainder labelled for planting in the Karroo Garden. Quantities of various species of *Richardia, Gladiolus Blackwellii* and *Galtonia* have been pricked out to attain flowering size. Propagation of trees and showy flowering soft-wooded shrubs has resulted in such plants as *Sutera grandiflora, Lobelia campanulata, Diascia Aliceae, D. Barberae*, various *Plectranthus, Iboza*, etc., being available for the Terrace Beds, and other sites. The general stock of all plants has been overhauled and given more attention.

In the Fern Dell further trees, flowering shrubs and perennials have been planted out. Numerous species of Crassulas have been used for bordering to the paths, and Nerines, Strumarias and Hessias planted among them. All species of Kniphofias have been lifted, divided up, and replanted to form larger clumps or masses. On the upper side of the main path on the north slope 1,700 square yards have been cleared of stumps, and trenched for trees, and for massing of varieties and species of *Agapanthus*, etc.

On the upper part of the Karroo Garden 22 plants of tree Euphorbias have been planted out. The Mesembrianthemum bank, along the south side of the road to the Fern Dell, which forms the lower part of the Karroo Garden, has been re-dug and re-planted with Mesembrianthemums. An additional area of about 3,000 square yards has been cleared of tree stumps, trenched and graded to improved slopes. The area has been divided by paths, 100 yards of 4 feet and 80 yards of 6 feet; with 2 sets of 3 steps and a flight of 7 steps to rise up the bank at the roadside. Selected flat stones have been used, and arranged to give suitable pockets, etc., of good soil for planting. A gutter has been made to each to carry the surface water down. About two-thirds of the above area have been planted with Mesembrianthemums from the beds; dwarf and procumbent species being used for groundwork, with shrubby species as dot plants and masses. *Crassula arborea, C. portulacoides* and *Portulacaria afra* have also been used in mass for accent.

On the Lawn, on either side of the stream, borders aggregating 500 square yards have been trenched and planted with masses or clumps of Gladioli, Wachendorfias, Dieramas, Watsonias, *Bulbinella*, Cape Willow, Palmiet, *Orphium, Indigofera, Priestleya*, etc., etc. Around the edge of the Pond *Gladiolus cardinalis, Crinum campanulatum, Dipidax triquetra, Schizostylis coccinea*, etc., have been massed. On the north side of the Lawn, from Nursery Bridge to near the oak at centre, a path, 10 feet wide, has been marked out, and excavated for 80 yards for the stone foundation. The soil has been used for grading the surrounding ground. Within the path about 240 square yards have been cleared of brambles, etc., trenched and levelled.

In the beds of the Terrace displays have been secured of *Delphinium macrocentron, Lobelia campanulata, Sutera grandiflora, Charieis heterophylla*, etc.

In the Pelargonium and Daisy Gardens various species have been planted out, masses increased, and effective

displays secured by plants raised from seeds and cuttings. Various species of Daisies are reproducing themselves freely.

An improvement has been effected in the Cycads by cultivation and the use of natural and artificial manures.

There have been planted in the Protea Garden 106 seedlings raised in the Nursery, including additional species to the collection.

In the Heath Garden 325 seedlings have been planted out.

In a natural Swamp near the Skeleton Ravine path about half an acre has been cleared of pine, poplar and other scrub; and desirable ferns, reeds, etc., cleaned or cut down to allow *Drosera, Xyris, Utricularia, Osmitopsis, Gnidia,* etc., to re-establish themselves; various Heaths, Proteaceae, Orchids and other plants requiring the conditions available here have been planted out in prepared ground. Intersecting paths throughout the cleared area, a main path around the south side joining up with the Heath Garden, and from the south-east corner around to the north-east corner, have been lined out by pegs.

A hedge, 200 yards long, of *Carissa grandiflora* has been planted in a prepared trench along the road side of the Nursery site. On the opposite side of the road a hedge of *Royena glabra* has been planted.

In the Economic Grounds stands of various sizes have been established of Liquorice, Camomile, Pennyroyal, Valerian, *Ocimum sp., Monarda sp., Chrysanthemum cinerariaefolium,* and a few plants of *Marrubium,* Aconite, Colocynth; in shrubs, stands of *Rosa damascena,* Australian Salt Bush and Spek Boom; and in trees a few plants of Kei Apple, Japanese Hawthorn, St. Helena Redwood, *Hovenia dulcis, Pouteria suavis, Feijoa Sellowiana,* grafted Carobs, Mesquit Beans, *Eucalyptus citriodora* and *E. Smithii.*

The stone bridge over Skeleton Stream has been completed. Split weathered stone was used for the capping, and the joints moulded to the slopes of the stones. Kerbing and guttering have been fixed on each side of the road, and the side paths gravelled, to the length of the bridge.

Around the front of the Aloe Kopje, Pelargonium and Daisy Garden, and along the Terrace the roads and paths have been gravelled to proper levels and cambers. The dip at the foot of the Dell has been filled up with stone and the surface gravelled. On the road to the Entrance, two French drains have been made to carry seepage from the bank under the road, and 16 feet along the centre of the road re-gravelled to levels.

Kirstenbosch. J. W. MATHEWS.

SOUTH AFRICAN IRIDACEAE.

ALL the world over South Africa is famous for her Iridaceae—her Klossies, Baviaantjes, Afrikaners, Fluweeltjes, Uiltjes, Painted Ladies, Bluebells, Kalkoentjes, Grassy Bells, as we call them at home when we are on really friendly terms with them.

What a glorious company it is that passes before us throughout the year! And could there be a more heavenly family-name to embrace them all than that derived from Iris, the "golden-winged," the dear "wind-footed fleet Iris" of Homer's Iliad, the messenger of the gods, uniting these with mortals as the rainbow, her pathway, unites the heavens and the earth? Nor are her namesakes unworthy of this goddess, "beautiful in wind-woven raiment of sunset hues." For do they not indeed reflect all the colours of the rainbow? In *Gladiolus* alone we shall find them—red, orange, yellow, green, blue, indigo, and even violet, in the most delightful combinations. And so it is with *Ixia, Moraea,* and *Homeria,* where green and blue and purple again mingle with the yellows and reds. *Watsonia* has many tints of pink—salmon, flesh, shell, coral and rose, as well as wine-purple, crimson, red and brick, and the whitest of all white flowers, for in Arderne's Watsonia even the pollen is white.

There is infinite variety, too, in the build and stature of the plants—from the lowly Romuleas, and the Galaxias which carpet the ground with their galaxies of flowers, the slender Ixias, the delicate-stemmed *Dierama* of fairy-like grace and beauty, the tall, sturdy Watsonias, and the regal *Aristea* which in early summer rears its sceptre of blue above the surrounding growth.

Equally variable is the habitat of these Irids. On dry hill-sides, on mountain tops, bordering streams, or in swamps, or even in vleis—for *Gladiolus biflorus* on the Cape Flats seems quite happy with one third of its stem under water. On the cliffs at Hermanus, almost in the wash of the spray, grows the Cliff Gladiolus (*G. carmineus*), a flower of rare beauty whose very existence on that account seems doomed. It flowers in autumn and is like the last pale pink flush left after the splendour of the crimson and golden sunset has departed.

* * *

Distribution.

There are some 800 species in the Family, contained in about 58 genera and spread throughout the tropical and temperate regions, but massed chiefly in Tropical America and South Africa, where about half the known species and more than half the genera are to be found. The two largest genera are *Iris,* which is entirely northern in its distribution, and *Gladiolus,* which is mainly southern. Probably *Gladiolus* with about 150 species, of which over 100 are South African, is the largest genus. *Moraea* is also native to Australia and *Romulea* occurs in Europe, but the rest are either entirely African or do not extend beyond Madagascar, as in the case of *Watsonia, Aristea,* and *Geissorhiza.* Every genus (except *Pillansia, Cleanthe,* and the very rare and local *Klattia*) is represented in the National Botanic Gardens,* more especially *Watsonia* of which there is a magnificent collection.

*We possess plants of *Pillansia* and *Cleanthe,* but they have not yet flowered.—ED.

Description.

Two or three of the Watsonias and Moraeas, *Aristea*, *Bobartia*, *Klattia* and *Witsenia* are evergreen perennials, but the great majority die down after fruiting and rest below ground by means of a corm or rhizome. Both these resting-stocks are underground stems, swollen with reserves for the next season's growth. The corm is more or less globose in general shape and is protected by several layers of fibrous covering. Besides the slender feeding roots, corms are often provided with one or more long and swollen roots known as contractile roots, because they contract in drying, and so pull the corm down to its proper level under the ground. Sometimes these interesting structures occur on one side only, and so tend to pull the corm obliquely and to fresh feeding-ground. The rhizome, bearing scale-leaves, is cylindrical and is horizontal and creeping.

Both the evergreen perennials and the herbs with perennial rootstocks and annual shoots show marked xerophytic characters in their leaves. Frequently only one full-sized leaf is produced and this is often elongated, trailing, narrow, and grass-like, with the margins and midrib variously dilated and thus affording cool areas into which the stomata open; or they are terete, and have the stomata deeply sunk and specially protected, as in *Bobartia;* or again they assume the erect position, sometimes spirally twisted, as in *Gladiolus grandis* and *G. tristis*, as if to make them stand up; or they are broader with strong supporting veins, and arrange themselves alternately one over the other. These arise from the very base of the stem, those arising higher on the stem being much reduced in size.

The largest flowers are to be found in *Moraea* (*M. iridioides* with a spread of three inches or more) and *Gladiolus*, and the smallest in *Micranthus*, a rather stiff, summer Irid with closely packed blue flowers on each side of the flowering-axis, "looking before and after" like Janus himself in whose month they flourish.

The flowers are either sessile and then are usually arranged in spikes; or they are pedicellate and are in clusters of about 3 enclosed in a spathe, there being often many such clusters to form the whole inflorescence. They are often regular as in *Moraea* and *Ixia;* or sometimes there is a slight irregularity caused by the stamens being drawn to one side, as in *Sparaxis* and *Tritonia;* or the irregularity goes further by reason of the back petal and side sepals becoming larger than the others, and the stamens and style arching under the former, as in *Gladiolus, Antholyza* and others. The parts are arranged in threes, as is usual with the Monocotyledons, and twelve members make up the whole flower—viz. three petal-like sepals, three petals, three stamens (the inner whorl being suppressed, except in *Watsonia* where staminodes are sometimes found), and three carpels. The sepals and petals are sometimes free as in *Moraea* and *Homeria*, but much more often they are all united to form a tube of varying size and shape—sometimes very slender and only large enough to admit a bee's tongue, as in *Ixia*, sometimes cylindrical, or funnel-shaped and large enough to house a big carpenter-bee. The stamens are very rarely united, as in *Galaxia* and *Homeria*, (from which character the name is derived:—homereo = unite), being usually free from one another and joined to the sepals. The anthers consist of two lobes and face outwards, except when the stamens are arched and the anthers specially placed to meet the pollinating visitor. The pollen is shed by longitudinal slits. The carpels are united as far as the stigmas which are of diverse length and form—flap-like and with petaloid crests, as in *Moraea;* somewhat spoon-shaped as in *Gladiolus;* sometimes very short, as in *Galaxia*, or long and thread-like, as in *Hesperantha;* and sometimes, as in *Watsonia*, they are divided into two thread-like branches. The ovary is inferior with usually an indefinite number of ovules in each of the three cells. The top of the ovary serves as a nectary. The fruit is a rigid or membranous capsule, splitting down the midrib of each carpel, and the seeds rather small, about $\frac{1}{12}$ inch in diameter, roundish or angled or larger and provided with wings; or rarely as in *Antholyza praealta* they may be nearly $\frac{1}{4}$ inch in diameter, brightly coloured, and have the outer covering fleshy.

* * *

Seed Dispersal.

Sometimes the capsule splits to the bottom and the three portions spread out leaving the winged seeds freely exposed to the agency of the winds. In other cases (*Romulea, Homeria* and others) the capsule at first splits a little way down only, and remains in an upright position. As the plant is swayed by the wind a few of the seeds are tumbled out some distance from the mother-plant ("censer-mechanism"), and those that are roundish would tend to roll a little further. The bright colour and fleshy character of the seeds described above point to dispersal by birds, but no record of this being the case is available.

EXPLANATION OF PLATE III: SOUTH AFRICAN IRIDACEAE.

I. Sections of Foliage Leaves.—Fig. 1, Bobartia; 2, Romulea; 3, Gladiolus tristis; 4, G. gracilis; 7, G. alatus; 5, 6, Antholyza revoluta; 8, Babiana; 9, Aristea; 10, Watsonia.

II. Typical Flowers.—Fig. 1, Gladiolus, showing zygomorphic symmetry; 2, do., long. section; 3, do., laid out; 4, ovary, transverse section; 5, do., long. section; 6, Moraea, showing radial symmetry.

II. Bracts and Bracteoles (*Spathe-valves*).—Fig. 1, Gladiolus; 2, Geissorhiza; 3, Tritonia; 4, Ixia; 5, Sparaxis.

IV. Androecium and Gynaeceum.—Fig. 13, Homeria, showing monadelphous stamens free from perianth; 14, Galaxia, do. adnate to perianth, and showing short style-branches; 15. do., laid open; 16, Bobartia; 1, gynaeceum of Witsenia; 2, style-branches and upper portion of style of Romulea; 3, do. of Cleanthe; 4, do. of Tritonia; 5, do. of Ixia; 6, do. of Gladiolus; 7, do. of Geissorhiza; 8, do. of Watsonia; 9, style and style-branches of Hexaglottis; 11, style-branches and upper portion of style of Homeria; do. of Moraea.

V. Fruit.—Fig. 1, Antholyza nervosa; 2, A. aethiopica; 3, Acidanthera; 4, winged seed of do.; 5, Moraea; 6, seed of do.; 7, Homeria; 8, Dierama; 9, Aristea; 10, seed of do.

VI. Underground Resting Stocks.—Fig. 2, corm of Babiana stricta, showing feeding and contractile roots; 1, do., tunics removed, showing bud; 3, corm of Homeria; 4. do., of Lapeyrousia; 5, do. of Bobartia; 6, rhizome of Moraea iridioides.



Plate III.: South African Iridaceæ.

Pollination. Birds, insects, and the "lurking" spiders" are among the pollinating agents. *Watsonia*, *Antholyza*, *Witsenia*, and pre-eminently *Babiana ringens*, with its perch or "rat-tail," are adapted to bird-pollination. The sweet-smelling evening-flowers (*Hesperantha*, etc.) are no doubt visited by moths. Self-pollination is prevented chiefly by the device of having the stigmas ahead of the anthers in position, as in *Gladiolus*; or the anthers will be erect in the centre of the flower, while the stigmas are spread out between the filaments and are first met by the visitor crawling to the nectar by way of the perianth, as in *Bobartia*, *Ixia* and others; or if both stamens and style spread, then the style will be longer and, projecting beyond them, will be touched first, as in *Aristea*.

In *Antholyza Lucidor* the flowers are very markedly protandrous (stamens ripe before the carpels). In the male stage, although the stamens reach nearly to the tip of the petal, the anthers are well protected under it, while the stigmas, closely pressed together, are quite out of the way. In the female stage, however, it is the anthers which are out of the way, for the filaments curl backwards with the perianth-segments, leaving the whole field clear for the stigmas which have, meanwhile separated and expanded. The style, too, has slightly elongated, so that a pollinating visitor is nearly certain to come into contact with the exposed stigmas and so effect pollination.

If a cross should fail there seems to be every chance of self-pollination. For the general rule throughout the family, even in the case of the most fugitive flowers, is that the perianth does not fall immediately it withers, but persists for a few days. In *Aristea* it twists spirally, and in the process brings the stigmas and anthers into contact; and in *Moraea* the same object is attained by the characteristic coiling inwards of the sepals as they wither.

It is interesting to note how the pollen is protected from wet. Where the upper petal is hooded and the stamens are arched under it the protection is complete, as it is also in the case of *Moraea*, where the large petaloid style-crests make a roof over the stamens. In some of the Tritonias the flowers have a slight droop and there is partial protection given by the perianth, and in those flowers which close up during damp weather the protection is again complete. Perhaps the most interesting case of all is that of *Aristea* which has its anthers fully exposed to the rain and yet appears to keep its pollen dry within the pollen-sacs. Do these close at the approach of rain and open again when the clouds have dispersed? My own observations are of much too slight a nature to venture an answer to the question.

* * *

Movements. Many of the genera show "sleep-movements" in their flowers, as in *Ixia*, where the flowers in their drooping position very probably suggested the name "Klossies" or little bells. Some show "fainting-movements"—that is to say they droop during the hottest part of the day and lose their fragrance, and only regain their freshness as evening approaches. This is very noticeable in the Large Brown Afrikander (*Gladiolus grandis*) and in the Aandbloem (*G. tristis* var.). *Hesperantha*, the white evening-star flower, closes during the day and opens towards sunset.

* * *

Uses. Few families have added more treasures than the Iridaceae to the garden-world where *Freesia*, *Ixia*, *Gladiolus*, *Tritonia*, *Sparaxis*, *Watsonia*, and *Antholyza* take their place with *Iris*, *Tigridia* and other foreign genera. The corms ("uintjes") of *Moraea edulis* are boiled and eaten with great relish, and those of *Homeria* and other "tulps" contain poison and are very dangerous to stock. The leaves of certain species are also poisonous. *Iris florentina* and other species are used in the perfumery trade. Their rhizomes (known as Orris root) when dry are sweet-smelling and furnish the scent known as "essence of violets".

* * *

Summary. Herbs with perennial rootstock (corm or rhizome) and annual shoot, rarely evergreen, or very rarely evergreen and shrubby, erect, xerophytes or tropophytes, independent, monocotyledonous. Leaves arranged in spirals, alternate, often equitant, sessile, exstipulate, simple, parallel-veined, linear, acute, clasping or sheathing the stem, entire, glabrous or pubescent; inflorescence cymose; flowers actinomorphic or zygomorphic, trimerous, 4-whorled, perianth petaloid, aestivation imbricate (or in *Watsonia* valvate?), polyphyllous or gamophyllous, persistent; stamens erect, arcuate, or rarely declinate, free or rarely connate, usually adnate to perianth-tube, anthers extrorse, 2-lobed, dehiscing by longitudinal slits; gynaeceum inferior, syncarpous, carpels usually bearing many ovules; fruit a capsule, dehiscing longitudinally, seeds adapted to wind-dispersal; cross-pollination effected by birds, insects and spiders, ensured, chiefly, by the advanced position of the stigmas.

Note.—In Marloth's "Flora of South Africa", Vol. IV. this Family is copiously and beautifully illustrated. Even a glance at the pictures cannot fail to yield delight and profit. A closer study will assuredly increase these and give an additional interest and joy to meeting with the beautiful flowers in their living state.

* * *

The following is a key for identifying the South African genera in the field:—

Shrubby (i.e. with a well-developed, branched, perennial stem above ground).
- Perianth-segments longer than the tube.
 - Perianth-segments with a long thread-like claw **Klattia**
 - Perianth-segments not clawed **Aristea**
- Perianth-segments shorter than the tube **Witsenia**

Not shrubby (if perennial above ground the main stem below ground).

Flowers pedicellate.
Style-branches flat and petaloid.
Stigma flap-like, on the underside of the style-branches.
Perianth-segments not crimped **Moraea**
Perianth-segments stiffly crimped **Ferraria**
Stigma round the apical margin of the style-branches **Homeria**
Style-branches not flat and petaloid.
Stigmas 2-branched **Hexaglottis**
Stigmas unbranched.
Stigmas longer than style; perianth entirely yellow **Bobartia**
Stigmas shorter than style; perianth not entirely yellow.. .. **Aristea**
Flowers sessile, either solitary or forming spikes.
Stigmas unbranched.
Stamens monadelphous .. **Galaxia**
Stamens not modadelphous.
Flowers not forming spikes.
Flowers at the end of a peduncle **Romulea**
Flowers almost sessile in a cluster of leaves .. **Syringodea**
Flowers forming simple or branched spikes.
Leaves fan-folded (plicate) **Babiana**
Leaves not fan-folded.
Stamens equilateral.
Stigmas as long as style or longer.
Perianth crimson; rootstock a rhizome **Schizostylis**
Perianth not crimson; rootstock a corm .. **Hesperantha**
Stigmas shorter than style.
Bracts entirely membranous.
Perianth (excluding tube) bell-shaped **Dierama**
Perianth (excluding tube) cup-shaped.
Bracts toothed; anthers straight .. **Ixia**
Bracts lacerated; anthers twisted .. **Streptanthera**
Bracts entirely herbaceous, or membranous only at the tips .. **Geissorhiza**
Stamens unilateral, usually arcuate.
Perianth-tube very short, lower segments longer than the upper **Melasphaerula**
Perianth-tube well-developed, lower segments not as above.
Bracts lacerated.
Perianth regular **Sparaxis**
Perianth irregular **Synnotia**
Bracts not lacerated.
Bracts membranous, or if herbaceous then with brown tips.. .. **Tritonia**
(and some species of **Geissorhiza**)
Bracts herbaceous.
Perianth regular or nearly regular .. **Acidanthera**
Perianth irregular.
Perianth-tube filiform at base then suddenly becoming cylindrical **Antholyza**
Perianth-tube not as above, usually funnel-shaped **Gladiolus**
Stigmas 2-branched.
Stamens inserted in throat of perianth-tube.
Stamens unilateral .. **Lapeyrousia**
Stamens equilateral.
Perianth blue, about $\frac{1}{2}$ inch in diameter **Micranthus**
Perianth yellowish-red, about $1\frac{1}{2}$ inch in diameter **Pillansia**
Stamens inserted below the throat of the perianth-tube.
Inflorescence more or less horizontal, the flowers directed upwards **Freesia**
Inflorescence vertical, the flowers directed outwards **Watsonia**

Bolus Herbarium.
University of Cape Town. L. Bolus.

THE CULTIVATION OF SOUTH AFRICAN IRIDACEAE

THE number of species described in Vol. VI. of the Flora Capensis, published in 1896, is over 400, and with new species since described must now be upwards of 500. Neither space nor present knowledge will permit mention of every species. There are 32 genera of which the largest is *Gladiolus* with over 100 species, *Moraea* about 50, *Tritonia* over 30, numerous ones with 20's, 7 with only 2, and 6 with only one species.

The majority are "bulbous" plants, and so require a decided period of rest. Exceptions to plants with corms are found in *Moraea iridioides*, *M. bicolor*; *Bobartia* all species; *Cleanthe*; and nearly all species of *Aristea*, which have short creeping rhizomes and evergreen foliage. *Aristea fruticosa* and *A. corymbosa*, *Klattia* and *Witsenia*, differ in having hard woody stems, evergreen foliage, and fibrous roots. With age a hard woody rootstock is developed capable of throwing shoots at the ground level, which, to a certain extent, replaces older branches dying back from various causes. In *Schizostylis* the root system is one of fleshy suckers, which under drought may develop rudimentary corms. The tips of the suckers develop into plants with fibrous

roots. The foliage is evergreen in the sense that a clump is always in foliage by reason of the young plant continuing in growth up to the flowering stage which may be reached in one or two years. *Crocosmia* also suckers freely in the same manner, but always has well developed corms, and in a constantly moist soil is seldom entirely destitute of foliage. Both are shade-loving streamside summer-flowering plants. *Crocosmia* can be stored during winter, but not *Schizostylis*.

In garden practice the order has many bulbous plants with clearly defined periods of growth and rest, and which can be lifted and stored as expediency or climatic conditions demand; and a second class of plants which on account of their evergreen nature cannot be lifted or stored, but must occupy permanent positions in the ground at all seasons.

The first class of bulbous plants—but what is a bulbous plant? I have used the word in its ordinary sense, that "bulbous" means "like a bulb." Botanically there are no bulbs in Iridaceae. In this class the rootstock is a corm. A corm is like a bulb in its functions, so that this class may quite correctly be termed "bulbous plants." The resting function of the corms of this class takes place naturally under a prolonged absence of rain, but in different species this occurs at two distinct periods of the year which coincide with their geographical distribution. In general those native of the coast belt, say the Western and South-Western districts of the Cape, rest during the hot dry summer, growing and flowering during the cool moist conditions of spring and winter; whereas those native of, and from, the Midlands and Eastern districts of the Cape northwards to the tropics rest during the cold dry winter, growing and flowering under the moist warm conditions existing in greater or lesser degree during the summer of those parts. Briefly, and broadly, there are two distinct groups—Winter Flowering and Summer Flowering. Important exceptions occur among the western plants. Some, for love of moisture, as with *Moraea ramosa, Watsonia tabularis, Gladiolus tristis, G. cardinalis, G. hastatus, G. Pappei*, etc., are Summer Flowering but must be planted at the same time as the Winter Flowering as new growth commences with the arrival of rain. Others again, as in *Gladiolus brevifolius, Antholyza Lucidor* and *A. nervosa*, in which "the species has a greater right over the individual than the individual has over itself," flower and reproduce themselves in the hot dry weather in hot dry stony soil, followed by vegetative growth during the cool moist winter, to renew the corm and maintain the individual. A counterpart of *Gladiolus brevifolius*, which, by the way, belies its name as it has about the longest leaf in the genus, is found among Rhodesian plants in *G. Melleri*. These "exceptions" cannot be kept out of the ground long in any case, and are better if planted immediately and left permanently undisturbed.

The remainder of the first class of corms functioning in the ordinary way, but at two different seasons, are: Winter Flowering—*Moraea*, in part; *Homeria*; *Ferraria; Hexaglottis; Galaxia; Romulea; Hesperantha; Geissorhiza; Ixia; Streptanthera; Lapeyrousia*, in part; *Micranthus; Watsonia*, in part; *Synnotia; Gladiolus*, in part; and *Antholyza*, in part. Summer Flowering—*Moraea natalensis, M. polystachya, M. spathacea; Syringodea;* various species of *Lapeyrousia; Freesia; Watsonia densiflora, W. Pillansii, W. Galpini;* various species of *Tritonia*, and *Acidanthera;* and many Gladioli, as in *G. dracocephalus, G. psittacinus, G. Saundersiæ, G. quartinianus, G. primulinus*, etc. In practice, under Western Province conditions, *Freesia* becomes spring flowering when planted in April, and various Syringodeas burst into bloom with the rains of April and May. The *Watsonia spp.* mentioned are evergreen in foliage and are best treated as perennial and not lifted except for division. The species of Gladioli mentioned may be taken as a type of those bulbs most insistent on being lifted and stored dry during our winter, and replanted in September.

The second class of plants, which are evergreen and mainly Western, also require differentiation according to their requirements. *Moraea iridioides* and *M. bicolor* are Eastern and Northern in their distribution, and thrive under ordinary garden conditions with moisture throughout the year. The first species is particularly useful under heavy shade, and the second for a rather moist position. *Aristea Eckloni* and *Dierama spp.*, with the same distribution, demand full sun and more moisture, making admirable streamside plants. *Aristea fruticosa* and *A. corymbosa* are distinct dwarf shrubby plants that produce in vivid blue along the upper edges of the krantzes of the Zwartberg Mountains what *Rochea coccinea* produces in scarlet on Table Mountain. The last, at least, is a perverse subject resenting disturbance, so when once established should be left severely alone. It withstands snow in winter and drought in summer, so ought to be more amenable. *Witsenia* and *Klattia* are a similar type of plant, but larger in growth and foliage than the two Aristeas. Both are native to swamps with an essentially peaty and sandy soil with percolating water not far from the surface. The Bobartias and the other Aristeas are typical hillside plants thriving in any deep porous soil under the winter rainfall; the Aristeas showing a partiality for the partial shade of scrub and bush, and the Bobartias for more open sun-baked positions.

The most shade-loving plant of the Order is *Melasphaerula*, which delights in the dense shade of forest trees or massive rocks, followed closely by the Ferrarias, *Antholyza Cunonia, A. praealta, A. aethiopica, Schizostylis, Crocosmia, Moraea tristis, Gladiolus cardinalis, G. splendens*, etc. These are also partial to humus or leafmould.

Species that favour sandy moisture-laden soil during winter are *Antholyza Merianella, Watsonia humilis, Geissorhiza imbricata, Ixia polystachya, Gladiolus recurvus, G. biflorus, G. inflatus*, etc. Species favouring almost a pure sand are *Gladiolus carmineus, Antholyza Cunonia*, Ferrarias, various Romuleas, Babianas, Lapeyrousias and Geissorhizas.

From these examples it will be seen a close study of individual requirements is desirable to obtain general success under cultivation, and in addition patience and perseverance are essential as many of the choicest are

most impatient of disturbance, and require several seasons to establish themselves after removal.

Propagation of the majority is effected in quantity from seed which is freely produced. In some of the bulbous species also freely from " spawn " as in many Gladioli, etc., and from multiplication of the corm as in *Watsonia, Babiana, Dierama,* and the rhizomes in *Aristea, Bobartia,* etc. The evergreen species of shrubby habit can be propagated by cuttings, and *Schizostylis* and *Crocosmia* by division of the clumps. In *Gladiolus cardinalis,* and the Ferrarias by separation of the corms in the necklace formed in a wild state or on old established plants. *Freesia, Sparaxis, Streptanthera, Ixia, Babiana,* etc., produce a few flowers from seed the first year, and with most others of the bulbous plants flower freely in the second, especially if growth has been maintained from the start by artificial watering when rainfall is deficient. Seed should be sown with the advent of rain in March or April ; in its absence, if water is available, well soak the beds and secure the advantage of an early start. Seed should be sown very thinly as it is not advisable to transplant the seedlings until almost full sized corms are developed. The pronounced summer-flowering species should be sown from August to October and must be kept growing from the start. For the moisture-loving species a rich free alluvial soil with a good percentage of sand and humus is most satisfactory. And, subject to the exceptions already noted, a rich and well drained sandy loam will suit the majority of species dealt with generically.

The flowers of the Order are mostly very short lived individually, but make up considerably by their freedom. These, as in *Moraea, Bobartia, Aristea, Cleanthe,* etc., with the Romuleas, Sparaxis, Babianas, Ixias, etc., of which the individual flowers reopen on consecutive days, are dependent on a maximum of sunshine to expand fully. In *Gladiolus, Watsonia, Acidanthera, Antholyza, Dierama,* etc., the flowers are normally lasting and more or less independent of bright sunshine to reach their maximum effectiveness. This character combined with the varied and brilliant colours have enabled the hybrid Gladioli to secure and retain popularity down the centuries in the gardens of the civilised world, while their more gaudy relatives, demanding a maximum of sunshine, rapidly lost favour. I think all the colours of the spectrum are found in the Order, with blues and yellows predominating. Self colours generally, but in the Peacock Moraeas, *Witsenia maura,* various Babianas, Sparaxis, etc., are found wonderful combinations of as wonderful complimentary colours. The Watsonias stand out prominently in floral effect by their wonderful shades in a range of outstanding colours. Tall and stately, the vivid and varied shades of orange, salmon, salmon-pink, rose, rose-pink, etc., supply a telling effect for massing in shrubberies or woodland glades.

In foliage the plants of the Order are sparsely clothed and in many cases require the assistance of carpeting plants among which they may be dotted irregularly to produce the effect of a flight of butterflies. For planting among cobbled or flagged paths the tiny Syringodeas and Galaxias and the wiry leaved Romuleas are most suitable.

Kirstenbosch. J. W. MATHEWS.

CARNIVOROUS PLANTS OF THE CAPE PENINSULA.

CARNIVOROUS plants are not a numerous class (there are only about 400 species, ten of which occur on the Cape Peninsula), but they are particularly interesting in that they break down one of the fundamental distinctions between higher plant and animal life, namely, that while animals feed on plants or other animals, the plant manufactures its own food from gases and salts it takes in from air and ground. For these plants, though capable of manufacturing their own food to a certain extent, supplement it by capturing small animals by means of special apparatus of various kinds. They capture chiefly insects, hence they are often called " insectivorous plants," but as Plate IV, fig. 8 l. will show, any animal small enough to be caught may become their prey. Details as to the mode of action of their curious pitfalls and gins are to be found in Darwin's " Insectivorous Plants," still the classical work on the subject ; here we are concerned only with the two methods of capture shown by those growing on the Cape Peninsula.

Sundews.

Seven of the Peninsula species are Sundews (Drosera, family Droseraceae, from Gk. drosos= dew). Sundews are cosmopolitan, but particularly abundant in Australia. They are so called from the glistening dew-like drops of sticky fluid which are secreted by glands borne at the end of outgrowths called " tentacles " (fig. 6) on the upper surface of the leaf. These tentacles have the general appearance of small pink or red pins stuck all over the leaf, and shorter towards its middle line. When an insect alights on the leaf the sticky fluid acts like birdlime, snaring it very effectually. The stimulus due to its presence passes to the surrounding tentacles, causing them also to bend over till they come in contact with it, when the glandular heads pour out a secretion which smothers the victim. This secretion contains a digestive ferment which acts on the proteins of the insect, bringing them into solution, when they are taken up by the leaf. For some days the insect is held down by the glands, then the tentacles bend back once more to

disclose only a shrivelled remnant, its outer husk, all the soft parts having been digested and absorbed. Sometimes a dozen corpses may be counted on one leaf of the Cape Sundew. It may, of course, be pure chance that guides them there, but from the numbers trapped, one suspects some attraction in the sight of the glistening drops, or perhaps a scent imperceptible to our grosser senses.*

What can be the advantage to the plant of this curious means of adding to its food supply? That it *is* an advantage has been proved by various investigators who have grown Sundew plants side by side, some supplied with animal food (midges or meat or white of egg) and others not fed, and covered with gauze to prevent the capture of insects. The results have always shown a marked superiority of the "fed" over the "starved" plants, particularly in the production of flowers and seeds. This at once raises the usual question: "If this is an advantage, why do not all plants possess it?" which can only be answered by the usual reply, that different types of plants may differ very much as regards single biological advantages, and yet on balancing up their total equipment for the struggle of existence, they may be seen to be equally successful in their different ways. The counterbalancing disadvantage of the carnivorous adaptation shown by the Sundews lies in the need for a good water-supply to keep up the secretion of the tentacles, and plenty of elbow-room to prevent the sticky leaves from becoming glued to each other or the surrounding plants. They can grow anywhere where these conditions are fulfilled, but as a good water-supply generally connotes crowded plant-life, one learns to look for them in places where other plants have difficulty in growing although there is abundance of water. Such places are boggy spots on the Mountain, and places on the Cape Flats where the sandy flats soil is badly drained, so that it becomes almost sodden in the rainy season. In such water-logged ground the bacteria which convert decaying nitrogenous matter, in the shape of plant and animal remains, into nitrates (salts of nitrogen) cannot live, and this makes life in such spots difficult for most plants, for they need the nitrogen in the manufacture of their protein food, and can only absorb it in the form of nitrates. Thus, cut down to a carbohydrate diet, they are starved like a man forced to live on white bread alone. But the Sundews can draw on the insect life common in these wet places to supply their nitrogenous food, and thus these sodden and boggy spots are their own particular "place in the sun." At the same time, given the necessary water and space, they need not be confined to such spots. Thus the Large-flowered Sundew (fig. 3) and the Little Spring-flowering Sundew (fig. 2) are fairly often found in places on the Cape Flats where the sandy soil, though well-watered in winter, is not actually sodden, but all the same is poor in nitrates owing to the scarcity of animal and vegetable remains, and therefore unable to support a crowded vegetation. Here, again, their independence of a nitrate supply gives these Sundews an advantage only counterbalanced by the risk of the dry season setting in early and killing the plants before the seeds can be set. The winter rains supply them with enough water, and as both species fruit before the dry season begins, they can safely die down when summer dries up the surface soil.

* It must not be thought that all plants on which insects are caught by sticky hairs or secretions make use of them as food. This only occurs in plants having leaf-tentacles secreting digestive enzymes, like the Sundews. The use of the stickiness in other cases (*e.g.*, various heaths. Silene) seems to be to stop marauding insects from entering the flowers.

* * *

Some Experiments on the Cape Sundew.

The movements of the tentacles in the Sundew are easily induced and rather fascinating to watch. An account of a few observations on the Cape Sundew (*D. capensis*, fig. 4) is given here, for comparison by anyone who would care to try similar experiments with other species. To do this, it may be more convenient to have the plants in pots. Young vigorous ones should be selected and dug up carefully (the roots may go down four or five inches) with soil around them, and transported upright in a tin tall enough to preserve the leaves from damage by contact. The flower-pot should stand in a basin of water so as to keep the soil wet, and a bell-jar should cover the whole. If this is not available, a large jam jar or tumbler may be placed over individual plants, and tilted to allow for ventilation. If the plants are kept in a well-watered conservatory, it is not necessary to cover them thus, but the dry air of a room generally causes the secretion of the tentacles to dry up partially unless such a precaution is taken. Plants thus covered should be kept in a good light, but not in the sun, except on cold winter days. The experiments may be carried out by night or day, and should always be on young vigorous leaves whose tentacles all glisten with drops of secretion, as these react more quickly than the older leaves. The movements should be watched through a lens, both because this renders them more perceptible, and because the very real beauty of the leaf can only thus be properly seen. Tiny scraps of raw meat and white of egg, and dead flies and ants, were used for the experiments.

Food Stimulus.—Food particles were placed on the short tentacles forming the centre line of various leaves. The glands of the tentacles actually in contact changed in a few minutes from bright to dark red, a sign that the secretion of their digestive fluid had begun, and the free tentacles nearest the object generally began to curve in perceptibly towards it within five minutes. Those further away followed more slowly, and then the marginal ones, till at length every tentacle on each side of the piece would be seen to be curving inwards, (this might take an hour or more), and by the next morning they would be found all bent over and in contact with the object, giving the leaf a buttoned-up look at that particular point. Sometimes the response of the tentacles above and below the object would result in a transverse bending of the leaf, and with a large object, such as a house-fly, this might result in the whole leaf becoming bent over (cf. fig. 4). When placed near the end of the leaf, the whole tip would often curl over (cf.

fig. 5). Food particles placed on individual tentacles (the long outer ones) caused them to bend over till the particle was brought in contact with the shorter tentacles on the central part of the leaf, though this movement was generally slower than that seen in the contact stimulus described below, and might take a day to be completed. Particles of sand and glass caused a much slower response —sometimes none—and the tentacles soon curved back instead of remaining clasped over the object.

CONTACT STIMULUS.—The long outer tentacles were touched repeatedly during ten seconds, to imitate the struggles of an insect, and then watched. In vigorous young leaves, sometimes every tentacle experimented on began, in about a minute after the stimulus had ceased, to bend over, so rapidly that the movement could be followed even with the naked eye (and much more distinctly with a lens) and in about one to two minutes its head was almost in contact with the surface of the leaf. Sometimes the movement was imperceptible, taking half-an-hour or more to be completed, and sometimes there was no response. All three results might be given by tentacles on the same leaf. Tentacles thus stimulated to bend by contact usually straightened out again within the next twenty-four hours.

VISCOSITY.—To test whether the secretion was strong enough to trap a vigorous crawling insect as well as flies, an ant (the common Argentine pest) was placed on a leaf, and watched through a lens, which gave it rather the aspect of a tiger struggling through a jungle of glue-smeared trees. It floundered along, mired continually but always pulling itself free from the sticky grasp of the tentacles, till at length an antenna came into contact with the gland of one of the long tentacles. It pulled, but could not get entirely free—a rope-like line of the secretion still linked the tip of its antenna to the gland. It braced its legs against the bases of other tentacles and for six-and-a-half minutes strained back again and again, but could not break the rope. Then after a pause, apparently for reflection, it took hold of the antenna in its front feet, and a vigorous tug on it broke the rope. It would have needed a stony heart to continue the experiment after this long struggle, and so the ant was removed for solace to a cake-crumb, where twenty-five minutes were spent in cleaning off the traces of the secretion before it could turn its attention elsewhere. A clump of plants in the line of an ant-trail proved by the number of corpses that even these tough morsels can be caught and digested.

* * *

Notes on the Sundews of the Cape Peninsula.

Among the commonest of the plants frequenting damp places in our mountains are the two little Sundews shown in figs. 1 and 2 whose rosettes of reddish leaves glisten in the sun as though dew-spangled, from wet moss-cushions and sodden soil. The other three species shown in the plate are not nearly so common, but it will generally be found that where any of the five occur, there are a number of the plants grouped together. On digging up a clump the reason is seen, for the plants will often be found to have a common origin as outgrowths from a branching rootstock (fig. 7a), although if the soil is very wet this may have decayed away betwen them. Each plant gives off a swollen tuberous root or several roots, packed with starch (fig. 7b), and this enables it to perennate through dry seasons in which the above-ground parts die away. In *D. cistiflora* (fig. 3) so far as I have observed it, the part above-ground seems to be annual; in the rare *D. ramentacea* (not figured), which grows on high mountain slopes where the South-Eastern cloud provides moisture in the summer, it appears to be always perennial, but in the other species the amount of water present in the dry season seems to be the factor determining whether they shall die down or live through it.

The flowers are borne on a long stalk, which lessens the risk of the pollinating insects becoming caught. In *D. cistiflora* (fig. 3) and *D. pauciflora* they are usually solitary, but in the other species a number of flowers are arranged one after the other on the same side of the axis (figs. 1, 2, 4, 5.) It will be noticed from these figures that they are at first curved right over (like the young leaves—fig.7a), but as flower after flower opens the curve straightens up, in such a way that the open flower is always uppermost. The flower is regular and five-parted, but there are only three styles, which are bifid (figs. 1c, 2c, 4b, 5b), and in *D. cistiflora* and *D. pauciflora* again multifid (fig. 3c). The flowers are scentless but brightly coloured, (purple, rosy or white), and apparently adapted to insect visitors, but data as to pollination are lacking, and any information would be much appreciated.

A key to the species found on the Cape Peninsula is given below, those species growing wild at Kirstenbosch being marked by an asterisk. Besides these, there is only one other South African Sundew, a little rosette one growing on the Magaliesberg, in appearance very like the common English Sundew. The key has been based on leaf characters, so as to enable the plants to be distinguished even when not in flower. The following additional notes on each may help to identify them.

1. Little Spring-flowering Sundew (*D. trinervia*; fig. 2). This has a rosette of narrow leaves, and in

Explanation of Plate IV: Carnivorous Plants of the Cape Peninsula.

1. DROSERA CUNEIFOLIA. Plant life-size. Figure *a*, front of leaf; *b*, back of leaf; *c*, pistil; all enlarged.
2. DROSERA TRINERVIA. Plant life-size. Figure *a*, front of leaf; *b*, back of leaf; *c*, pistil; all enlarged.
3. DROSERA CISTIFLORA. Plant life-size. Figure *a*, stamen, outer surface; *b*, stamen, inner surface; *c*, multifid style branch; all enlarged.
4. DROSERA CAPENSIS. Plant half life-size. (N.B.—Other specimens may be nearly as small as actual size of drawing.) Figure *a*, leaf, somewhat reduced; *b*, pistil, enlarged.
5. DROSERA HILARIS. Plant half life-size. Figure *a*, leaf, somewhat reduced; *b*, pistil, enlarged.
6. Tentacle of Drosera leaf, much enlarged.
7. Vegetative propagation in Drosera. Figure *a*, rootstock of *D. capensis* with young plants growing from it; *b*, tuberous roots of *D. cistiflora*; both life-size.
8. UTRICULARIA ECKLONII. Plant life-size. Figure *a*, whole flower, side view; *b*, calyx; *c*, upper lip of corolla, front view; *d*, lower lip of corolla, front view; *e*, pistil and stamens; *f*, pistil showing stigma after contact; *g*, stamens; *h*, fruit (immature); *i*, runners with traps and leaves; *k*, bladder, external view of face nearest runner; *l*, bladder in optical section; all variously enlarged.



Plate IV.: Carnivorous Plants of the Cape Peninsula.

spring (Aug.-Nov.) small white flowers, with a purple tinge towards the base of the petal. This is the species common in the damp spots opposite the hospital on the Camp Ground at Rondebosch, and similar places on the Flats, where the soil becomes wet enough in winter.

2. Little Summer-flowering Sundew (*D. cuneifolia ;* fig. 1). This flowers in summer (Dec.-March) when the purple colour of the flowers at once distinguishes it from the former species. Young plants of the two look very much alike, but can be separated by the conspicuous connate stipules of this species (fig. 1a) which are reduced to a mere hair in *D. trinervia*.

3. The Simonstown Sundew (*D. pauciflora* var. *minor*) has so far only been recorded from the mountains above Simonstown. Possibly it may be more common, but its rosette of exstipulate leaves is so like that of *D. trinervia* that the plants can only be distinguished when in flower. It also flowers in spring, but the flowers are usually solitary, cream-coloured, and larger than those of *D. trinervia*, and the styles are multifid.

4. The Cape Sundew (*D. capensis ;* fig. 4) is a summer-flowering species, and like the Little Summer-flowering Sundew is found only in places such as Kirstenbosch swamp where the moisture lasts long enough to carry it through its flowering season. The leaves grow up in a tuft from a short stem.

5. The Hilarious Sundew (*D. hilaris ;* fig. 5) is locally frequent, though not a common plant. Full grown plants can be distinguished at once by an "hilarious" look, difficult to define in either drawing or print, but marked enough to have given the plant its specific name. The way the leaves straggle in all directions down along the stem imparts to it a curiously intoxicated air, so that clumps of it before flowering irresistibly suggest a party of revellers coming home in the small hours. It grows abundantly in winter and spring (when it flowers) on the right hand side of Kirstenbosch contour path approaching Nursery Gorge from the North side. Young plants which have not taken on the height (up to six inches) or the "dissipated" appearance of the older ones can be distinguished from the Cape Sundew by their stipules, which are cut up into a fringe of narrow hair-like strips, whereas those of the Cape Sundew are entire or only slightly cut at the apex (cf. figs. 4a and 5a). In both, the stipules are joined to form a conspicuous membranous piece lying between leaf-base and stem.

6. The Long-stemmed Sundew (*D. ramentacea*) has been recorded in the Peninsula only from the tops of Table Mountain (east side) and Noord Hoek Mountain. (Records from other localities would be welcomed). The plants are perennial, evergreen, often branched, grow up to 2 ft., in height, and have a curious "leggy" appearance, due to the living leaves growing near the apex of the stem, which is covered below by the remains of the old ones. Their height distinguishes old plants at once from all the preceding species, while the deeply cut-up stipules further differentiate it from the Cape Sundew, and the narrower leaves and long narrow petioles, as long as or longer than the blades, from the Hilarious Sundew. All these three species have purple flowers.

7. The Large-flowered Sundew (*D. cistiflora ;* fig.3) is so named from the beautiful large cream-coloured or pinky-violet flowers which crown the long slender stem. It is fairly common on flats and slopes, flowering in spring and dying down in the dry months. In the Darling district this species occurs with vivid scarlet petals, and is one of the most conspicuous of the spring flowers.

Key to the Species of Drosera.

Leaves forming a rosette appressed to the ground (in *D. pauciflora* occasionally several on peduncle.)
- Stipules conspicuous .. CUNEIFOLIA,* Thunb
- Stipules none, or reduced to two threads.
 - Flowers 3-6, styles bifid .. TRINERVIA, Spreng
 - Flowers usually solitary, styles multifid PAUCIFLORA, Banks, *var.* MINOR.

Leaves not forming rosette
- Stipules present, connate
 - Stipules entire, or lacerate only at apex CAPENSIS,* Linn.
 - Stipules deeply cut-up into narrow thread-like strips
 - Leaves at least $\frac{1}{4}$ in. broad; petiole shorter than blade .. HILARIS,* Cham. & Schl.
 - Leaves less than $\frac{1}{4}$ in. broad; petiole longer than blade .. RAMENTACEA, Burch.
- No stipules CISTIFLORA, Linn.

* * *

Bladderworts.

As common as the Sundews, and growing with them in damp spots from flats to mountain tops, is the little Bladderwort shown in Fig. 8. The Bladderworts (*Utricularia*) belong to the Lentibulariaceae, a family consisting entirely of carnivorous plants. There are 210 species of *Utricularia*, which live in water or damp situations, such as the swampy spots on the plateaux of Table Mountain, and supplement their food supply from the minute animal life swarming in such places, which they catch in trap-like bladders. Among the South African bladderworts, these bladders can best be seen in the Transvaal species, *U. diploglossa*, in which they are a sixth of an inch long and replace a segment of the much-divided floating leaves. The Bladderworts of the Cape Peninsula are much smaller terrestrial plants, with tiny bladders less than a millimetre long. Their pale-purple-and-yellow flowers at the end of a slender stalk are familiar in damp places throughout the spring and summer months. At first sight these flowers seem to be all there is of the plant; but if the flower-stalk is carefully dug up with some of the wet earth or moss surrounding it, and the parts below ground carefully dissected out (washing under a gentle stream of water is helpful), it will be found to arise from a system of white thread-like runners branching about in the soil (Fig. 8 i). Some of the branches of these runners turn downwards and act as absorbing and anchoring

*This species grows wild at Kirstenbosch.

organs; others turn up to the surface, and their ends flatten and turn green, forming leaves; but all parts are alike in their mode of origin, and it is evident that here we have a plant in which the usual distinction drawn between root, stem and leaf cannot be applied.

* * *

Bladders of the Cape Bladderwort.

The bladders may be developed at any point on the runners or leaves. They are so small that a microscope is needed to see their structure clearly, but so transparent that it can be easily made out with this aid (Fig. 8, k and l). A narrow passage leads from the outside into the cavity of the bladder, and at the top of this passage a semicircle of hairs projects over, forming a kind of stockade closing the end of the passage. The passage is oval in cross-section; the smaller diameter is shown in the figure. Tiny organisms—Protozoa (minute one-celled animals), Rotifers, Diatoms, Tardigrades, minute "worms" and crustaceans—that crawl and wriggle about in the wet sand and moss, often made their way down this passage, pushing back the hairs that guard the inner entrance; once past, these hairs, which are hinged at the base, fall back into place so as to cover the entrance again, and though I have watched many captives wandering round and round inside their prison, not one has been seen to make its escape. With prison and prisoner so minute (the bladders are only .5 to .75 of a millimetre long, exclusive of the short stalk), experiment as to the exact mode of entry and capture is difficult, but the external structure of the bladder leads to the suspicion that it is not mere chance that guides them to their doom. A double row of hairs (Fig. 8 k) runs along the side of the bladder opposite the stalk, and the ditch between these runs into the passage. It is difficult to avoid the conclusion that this converging run-way must assist in directing the movements of the little creatures that crawl over the bladder. Even if they should miss the entrance to the run-way and come up against the fence of hairs, a crawl along this might land them in the passage by way of one of the side depressions at the end of the fence. But whatever may cause the victims to enter, it is certain that these bladders are effective as traps. Captives, living or dead, or débris evidently resulting from their dissolution, were found in nearly all the bladders of a number of plants examined from different localities. There is no killing apparatus; the animals seem merely to die from want of food and oxygen, and their dead bodies form a kind of soup in the water filling the bladder. On the wall are quadrifid glandular hairs (Fig. 8 m), similar to those which Darwin showed to be used in other Bladderworts for absorbing the products of this decay.

* * *

Flower and Fruit.

Details of the flower are seen in Fig. 8, a-h. There are two sepals (Fig. 8 b) which persist round the fruit (Fig. 8 h). The corolla is two-lipped, and the lower lip spurred reminding one of a *Nemesia* (Fig. 8 a). The large palate formed by the lower lip is usually yellow, the rest of the corolla pale purple or mauve, but the proportion of the colours varies, so that sometimes the whole flower may appear yellow or mauve. The upper lip forms a shelter for anthers and stigma, and the lower lip is so close to it that the entrance to the corolla is closed. In the European species, the lower lip serves as a platform for insects, by whose weight it is depressed as they seek for nectar in the spur. Whether this happens in the Cape species, and what insects visit them, has not been recorded, and any information on these points would be welcomed. The stigma is two-lobed, the front lobe being just above and between the two stamens and the hinder reduced to a functionless point (Fig. 8 e). The front lobe is sensitive to contact, and bends upwards and backwards after having been touched (Fig. 8 f). (The stiff hairs on its upper margin are said in the European species to act as combs drawing the pollen-grains out of the visitors' hair when the lobe bends up.) The ovary is one-celled and the fruit a tiny capsule breaking open irregularly to set free the numerous very small seeds.

The preceding remarks apply to all three species of Utricularia which have been recorded from the Cape Peninsula. The rare Tubercled Bladderwort (*U. livida*, Mey., recorded so far only from the Constantiaberg) has, in addition, conspicuous tubercles on the palate; the other two species, known together as the Cape Bladderwort, differ only in the size of the flower, which may be nearly twice as big in the larger one. The smaller-flowered form (*U. Ecklonii*, Spreng.) is figured, but observations by Mr. E. J. Steer on plants growing on Lion's Head make it doubtful whether this should really be made a separate species from the larger-flowered (*U. capensis*, Spreng.). It seems possible that the two sizes of flower may be produced by the same species under varying conditions of soil and season. Dr. Stapf, who had to work out the South African Utricularias at Kew from dried material, says "A really satisfactory classification of this genus will only be possible when living or carefully collected and preserved spirit material is at hand." This applies to other genera besides *Utricularia*, and is one of the needs we look to Kirstenbosch to supply. A beginning has just been made with the problem of these two bladderworts by planting clumps of the two forms side by side in the swamp garden, under exactly the same conditions, and it is hoped that they will both flower this year and allow this problem to be settled in time for the solution to be published in next year's number of this Journal.

This is only one of the many points where our knowledge of South African carnivorous plants is defective. Some others have been indicated above, and any information which may help to fill up these gaps or otherwise add to what is known concerning them would be much appreciated by the writer.

Edith Stephens.

Botanical Laboratory,
University of Cape Town.

REPTILES AT KIRSTENBOSCH.

SNAKES and lizards are not generally popular animals: their cold, scaly skin, their unsympathetic expression and furtive habits bring down upon them as a class the disfavour of most people; while the methods of offence and defence adopted by snakes towards their enemies, whether by poison or constriction, inspire alarm and detestation. It is to be feared that reptiles will never become universal favourites, but will remain the darlings of a select few. At the same time they are animals of great interest and singularity; and though present at Kirstenbosch in quite small numbers it is important to know something about them and their appearance, habits and weapons. The following short notes include, for the sake of completeness, one or two Cape Peninsular species not known to occur at Kirstenbosch; and a few remarks are also offered on the treatment of snake-bite.

Of the three great groups of cold-blooded animals with backbones, Fishes, Amphibians and Reptiles, the last-named is the only one in which the individual breathes atmospheric air throughout life. The fishes obtain their oxygen from solution in water by means of gills; the amphibians (frogs, toads, newts) mostly begin life as aquatic larvae with gills and emerge from their early home in the water at maturity to breathe air with lungs; but the reptiles are born like their parents and breathe air from the first.

General Description.

Snakes and lizards are alike in many respects. Both live entirely on animal food. Both have imperfect hearts, so that the clean blood from the lungs mixes with blood that has passed through the body. Both breathe slowly so that the body is not so warm as that of the mammals; and as there is no mechanism for regulating the temperature, this varies to some extent according to the temperature of the surrounding air and soil. Some snakes and some lizards produce their young alive, while others of both groups lay eggs. Here, however, there is a slight difference: for the eggs of lizards have hard shells, while those of snakes have soft skins. Then again most lizards have well-developed legs, but a few have only small, useless legs or none at all; most snakes are without apparent limbs, but in the African Python a pair of small claws with rudimentary bones can be found in the position of hind legs, and in most snakes there are vestiges of pelvic bones. In fact there is a complete series of stages from well-limbed to limbless creatures among the reptiles. A remarkable peculiarity of snakes is that the eyes only have single eyelids and that these are permanently shut; being quite transparent however they do not obscure the vision, and in fact the eyes may be regarded as protected by goggles. Most lizards have movable eyelids, and some even have a third membrane which can be drawn across the eye; the true geckos, however, cannot move the eyelids, and the chameleons have eyelids united into one fold with a small central opening; a few lizards have the snake-like window eyelid. Many snakes have poison fangs, but only one small group of lizards from Mexico and Arizona is poisonous. The South African lizards are quite harmless to man. The body is covered with a scaly skin or scaly outgrowths of various forms, as in the fishes. These reptilian scales are supposed to be the ancestors, as it were, of fur and feathers, the typical clothing of the mammals and birds. Many now extinct reptiles, often of huge size, are known to have existed in past ages, and some of them can be found as fossils in the rocks of the Karroo.

Of the other two living groups of Reptiles, the Crocodiles do not occur in the Cape Peninsula, being in fact extinct in the Cape Province; but the tortoises are represented by a single species occasionally met with at Kirstenbosch. The Tortoises are distinguished from all other Reptiles by having toothless horny jaws, and by the body being enclosed in a bony shell, usually covered with horny shields.

The Tortoise.

Tortoise.

The slow-moving tortoise is not really quite as slow as he is supposed to be. True he cannot move as the hare—but just take your eyes from him for a few minutes and where is your tortoise now?

And granted that he is slow, would not you find it slow and difficult work to get along if your skeleton were disarranged so that your shoulder-blades were across your chest and your collarbones at the back? Well that is what the poor old tortoise has to put up with. However he has one great advantage over us and that is no one can tickle him between the ribs because "He ain't got no between." No, his ribs have become flattened out so that they not only meet, but are actually dovetailed together just as are the bones of our own skulls.

If you examine the horny plates on the back of a tortoise you will easily see how wonderfully they are enlarged, as time goes on, by growing all round their edges so that they show little ridges, or, if I may use the term, "hexagonal rings" so that the oldest part of each plate is the centre. The male tortoise has a saucer-like depression on the ventral surface of the shell.

Tortoises bury their eggs in a warm slightly moist place and then leave them to hatch by themselves.

The food of the tortoise is, for the most part, of a vegetable nature but they are said to be rather partial to slugs, although I have not observed this peculiarity for myself. Also they seem to enjoy bread especially if it is allowed to get rather stale and is then soaked in water. The plant which is best enjoyed is, I think, the common yellow sow-thistle (*Sonchus oleraceus*) which is to be found in practically any neglected garden. I have not found that tortoises show any great affection towards

their owners. Care should be taken not to allow children to feed tortoises by hand as the bite is rather severe and would probably mean the loss of a mouthful of finger—not that the tortoise is a vicious animal, but it will seldom let go of a mouthful of food.

The Lizards.

Skink. The common Skink (or "Akkerdis") is found all over the Cape Peninsula. It scarcely needs describing, as it is so easily recognised by its dark body which bears three fairly distinct lines of a lighter colour besides the more or less irregular spots on the back. It has, like most lizards, short legs which are armed with claws.

The akkerdis makes a very interesting pet and is very easily tamed. Perhaps it may interest some of our readers to know the method adopted in taming. First of all a great deal of patience is required. Having this qualification it is only necessary to obtain a slender stick about 4 ft. to 5 ft. in length. Catch, kill and impale a grasshopper on the end of the stick and very gently offer it to the lizard. You may have to wait a minute or two, but it is almost certain that the lizard will accept your offering. Suppose he runs away—do not be discouraged, wait a moment and he will re-appear. When he has taken, say, three grasshoppers, break your stick in halves and thus get nearer to him; give him a few more, and again shorten the stick; keep on in this way until you can feed him from your fingers. Do not be surprised if he turns savage (or cheeky) and bites your fingers instead. He can do *no* harm and it is amusing to see him trying to tear out a mouthful of flesh.

Even if you do not care to tame these little friends of man you should, if you have a garden, allow several of them to live amongst your plants, as they enjoy a nice meal of caterpillars and grasshoppers.

I should mention that care must be taken not to hold a skink by its tail, as it can be thrown off at will, and then you will have to wait some time for the new tail to grow. This new tail is always darker than the original. There is no truth in the common belief that "lizards can take up and replace the abandoned tail." That tail is left to be devoured by the enemy whilst its intended victim escapes.

Klip Salamander. Another lizard which is very common at Kirstenbosch is the Klip Salamander or Black Rock Lizard. It likes to bask in the sunshine but on the approach of danger it immediately retires to some convenient crack in the rocks, whence it is very difficult to dislodge it; in fact it will wedge its head in so tightly that it is almost impossible to move it without killing the lizard. Its tail, too, is very brittle and is thrown off at will, although it is more frequently used as a shield, and, being spikey, it is a very good shield too. When in use as a protection it is brought beside the body until the point touches the head.

The principal diet of this lizard seems to consist of cockroaches and beetles. It does not make a very good pet as it is inclined to "sulk" in captivity.

Kogelmannetje. The "Kogelmannetje" or Blue-headed Rock Lizard is a very handsome fellow and makes a nice pet, as it can be taught to feed from your hand. But first you have to capture it, a matter of considerable difficulty, unless you have learned to distract its attention with one hand whilst you make a quick grab with the other. Of course you may drive it into a crevice in the rocks and then drive it out again with thin twigs, but you must be very quick as it is an excellent climber and jumper. Its tail does not fall off, so it is safe to catch hold of it as an aid to capture. The *agama*, to give it its proper name, eats grasshoppers and other insects.

Gecko. Speaking of fragile tails reminds me that I must not forget the innocent little Gecko or "Geitjie." This little chap lurks under the bark of trees during the daytime, but at night it becomes very active in its search for moths, mosquitoes and other night-flying insects. It has the evil reputation of being deadly poisonous, but it—I almost said "it could not harm a fly," but that would be very untrue as it is very fond of flies, in a way—but it is certainly not poisonous and its jaws are so weak that its bite cannot be felt, apart from the fact that it is not in the least aggressive. In fact its juicy tail (I'm sorry if you are tired of tails) is its only defence, and since it surrenders that so quickly it cannot be held to blame.

An interesting point about the gecko is the fact that it bears suckers on its toes and thus can climb up a pane of glass.

Chameleon. The Chameleons are so distinct from other lizards that they are frequently put into quite a separate sub-order. The tail is not brittle and is prehensile. Each foot is divided into a group of two fused toes and a group of three, and makes an excellent clasping organ; so that the chameleons, though sluggish, are splendid climbers.

A very interesting point about the chameleon is the fact that it is able to use each eye independently of the other, but it has to bring both eyes into play before it can capture its prey. When a chameleon sees a fly it advances even more deliberately than usual—which, by the way, is saying a lot—and squints, literally, at it whilst taking aim with its long sticky tongue.

The tongue might be said to consist of three parts: 1st, the aiming part, which is a slender rod of gristle over which is drawn the 2nd or sleeve part which is really a long elastic tube that can be extended to an average distance of 3½ inches. On the end of this sleeve is a sticky blob of flesh and this blob is the part which is thrown against the unfortunate fly.

There is still a great deal of controversy with regard to the change of colour of a chameleon but I, personally, am satisfied that the animal has no more power of changing at will than we have of blushing. The change to my mind is due to emotion only and in proof of that I have found that *black* seems to be the fear colour. Make a chameleon afraid and it will turn not really *black*

but a very bright green with a lighter "centrepiece" on either side.

You may argue "green twig—green colour." Quite so. Now, please shut up half-a-dozen in a box and leave them there for, say, an hour. Since they have been in the dark they *should* all be black but they are—well, try the experiment and you will in all probability have as many different hues as there are chameleons.

The young of the chameleon are born alive.

The chameleon is scarce at Kirstenbosch but is occasionally seen by sharp-sighted persons. It makes a charming and docile pet; but if you have one as a pet, please let him have access to water, as, contrary to the popular belief, chameleons do drink. A good plan is to sprinkle water on his bush or twig.

Sweepslang.

A common though rarely seen lizard is the Sweepslang (Whip Snake): of course it is not really a snake at all; but one might be forgiven for thinking that a moving '*anguis*" (its scientific name) is a snake. I have one alive at present, and it is about 15 ins. long and as thick as an ordinary pencil. It has four rudimentary legs, which are apparently useless in travelling, as most of the propelling power seems to be in the tail, which is of exceptional length. An *anguis* 24 ins. long would have a body less than 6 ins. in length. This lizard very closely resembles a dried twig and will move rapidly for a few feet and then remain perfectly motionless; it takes a trained eye to spot it when it makes up its mind to "lie low and say nothin'." Once more I must warn our readers of the fragile tail.

In conclusion, I should like to refer to two other lizards which live underground and are commonly known as Sand Snakes. One is golden in colour and has no limbs, whilst the other, the silver sand-snake, has a pair of rudimentary hind-legs left. These lizards, which feed on ants' "eggs," are able to burrow very quickly in the soft earth.

The Snakes.

Puff Adder.

The Puff Adder, though usually very sluggish, knows how to move and to strike quickly when aroused. The fangs are often more than half an inch in length; hence, one has to cut deeply when treating a bite. This snake, however, seldom strikes without giving a long hiss of warning; of course if trodden upon an instant bite is to be expected, and small blame to the snake.

The colours of this snake make it very difficult to distinguish from its surroundings; it is a dark green and yellow variegated pattern on the back and yellow on the underside. The triangular shape of the head and the great thickness of the body are sufficient to identify a fully-grown specimen. Average length 3 ft. to 3½ ft. Found on the mountain and the flats, especially near water. Its food is principally rats, mice, moles and birds.

The Puff Adder is easily tamed and becomes affectionate. N.B. The Puff Adder strikes *forward*, not backwards, as is popularly supposed.

Berg Adder.

Like the Puff Adder, the Berg Adder has very long fangs. It is not an aggressive snake, but is unlike the Puff Adder in being practically untamable. Its colour is a slaty-brown with an almost imperceptible line down the centre of the back, this line being met on alternate sides by semi-circular bluish-grey markings, which if they were complete circles would cut each other, ringed with lighter (often orange) markings. One of my brothers very nearly tried to "pick" one of these marks from the back of a Berg Adder which was lying amongst some sour-fig rank; his hand was within a few inches of the snake before he noticed his mistake. The Berg Adder is found on the mountain and the flats: it is not very rare. Its food consists of field mice and small birds in particular, although, like most snakes, it does not mind a change of diet. A specimen 18 ins. in length would be considered very large. It can jump up to a height of 6 ins. to 12 ins.

Horned Adder.

The Horned Adder is best described as sandy speckled with dark brown and black—somewhat resembles weathered sandstone. It is about 9 ins. to 15 ins. in length and has very long fangs, and like the Berg Adder, is able to jump a few inches from the ground. This snake has a habit of burying itself in the sand in such a way that only the top of the head and, of course, the eyes are exposed. It is frequently to be found under the black antheaps, which are so common on the Flats. On one occasion I turned one of these antheaps, and in doing so I left the imprint of my fingers, in ridges of sand, on the back of one of these Horned Adders, which lay so still that I went away without noticing it: a friend, however, saw and drew my attention to it. The name Horned Adder is derived from the two bunches of scales which formed raised eyebrows. This snake is, I believe, untameable.

Brown or Speckled Cobra.

The Bruin Kapel, or Speckled Cobra, is found all over the Cape Peninsula. It does not attack, as a rule, unless cornered or during the mating season (Spring): once angered, however, it can move at a great pace, especially in bushy country, and is no mean climber; in fact it is frequently to be met with in birds nests, and one cannot be too cautious when putting one's hand into such nests as those of the finch.

Personally I believe that cobras do not care to waste their poison on human beings and animals too large for them to swallow. I have been struck by the nose of cobras, who could easily have bitten if so disposed. Overcome the horror which you naturally have and you will notice that the cobra has a kind expression on its face (or is it only my fancy?). The large hood just below the head is a distinctive mark of the cobra family. Length up to 7 ft.

Yellow Cobra. The characteristics of this cobra are so like those of the speckled variety that, beyond stating that the colour varies from light cream to light brown, there is no need to go into detail.

Ringhals Cobra. The Ringhals (or Ring-throat) is a small kind of cobra; it may be described as a black snake well spotted with yellow, in fact there is as much yellow as there is black on this snake; the underside, however, is black except for one, two or even three rings on the throat. A very interesting point about the Ringhals is its power of spitting—to a distance of 5 ft. or 6 ft.—and it seems to know that it should aim for the eyes. This spittle causes intense pain; men have been known to roll, screaming with pain, on the ground, after getting a full dose in the eyes. The poison has also the effect of blinding the victim for some days; after which the sight is gradually recovered. The best treatment I know of is clean water with just a dash of vinegar—*do not* use permanganate—say, half a teaspoonful to a tumbler of water. Another playful habit of the Ringhals—and he is very clever at it, too—is shamming death. The body is twisted in such a way as to turn the head upside down, the neck is flattened, the mouth slightly open and the body quite limp. In this state it can be freely moved about with a stick—but just put your hand within striking distance and you will see a marvellous recovery and a lightning stroke. Should the snake have misjudged the distance and missed your hand, look out for your eyes; it rears and spits immediately. I find the safest way to watch one of these snakes is to put your arm across your forehead in such a way as to cover one eye with your wrist and leave a small peephole, under your elbow, through which you look with your other eye.

Length of Ringhals up to about $3\frac{1}{2}$ ft. It is tameable, but I should not advise anyone to take liberties.

Garter Snake. There is no mistaking the beautifully banded yellow orange and black Garter Snake, with its orange stripe down the back. This snake has a very small head and cannot open its jaws to the same extent as most of the snakes. The fangs grow so long that an old garter snake is frequently unable, on account of their length, to erect them, and is therefore less dangerous that the youngsters. However, it is as well not to trust to the fact that he may be unable to use them as there are exceptions to every rule and he may be the exception. On the whole the garter snake is a very inoffensive little chap. Length up to a couple of feet. Found on the mountain and flats.

Boomslang. The Boomslang is not uncommon on the slopes and top of the mountain and is sometimes found in the low scrub and bracken. The eyes are large and give an expression of extreme gentleness and timidity. The timidity is certainly there and so are a very useful set of fangs—though I, personally, do not regard the bite of a boomslang in the same light as I do the bite of, say, a ringhals. There is not the slightest doubt that it is a poisonous snake; in fact I saw a pigeon die $2\frac{1}{4}$ minutes after being bitten, but I should be surprised to hear that a healthy man had succumbed to its bite. The grooved fangs, however, are almost certain to be dirty and septic poisoning may be set up unless the wound be sucked at once. Please do not think that I for a moment advocate neglect of such a bite—but, on the other hand, let me entreat you not to die of fright or of imagination, both of which are, I believe, frequent causes of "death from snake-bite."

Reed Snake. This snake closely resembles the Skaapsteker, but is "oil green" (I quote Smith) with a dark stripe with still darker blotches running down the back; in addition, it has a good sprinkling of minute white spots all over the back and sides: there is a small white speck immediately in front of the eye. It grows to a length of 2 ft to $2\frac{1}{2}$ ft., although the latter would be considered a rather large size. As its common name implies, it is found in the clump of reeds (Restionaceae) which grow in fairly damp places on the Flats; it is not often met with on the mountain. I have found that a neglected (*i.e.* unsucked) bite from one of these snakes was sufficiently poisonous to cause my hand to swell to such an extent that I could not clench my fist. Food: mainly frogs and an occasional mouse.

Night Adder. I know of at least four different snakes which bear the name of "Night Adder." The particular species I am about to describe is *not* an adder. The Night Adder is a greenish yellow snake with a black head which, however, appears in some lights to be steel-blue. This snake makes a great show of being poisonous, but was, until recently, classified as non-venomous. The Director of the Port Elizabeth Museum has discovered that its bite is as dangerous as that of the Puff Adder, but it must get a fair grip as its fangs are set far back in the jaw. For some reason this snake seems reluctant to bite, and for that reason I treat it as I do the non-poisonous snakes. Many a time a night adder has actually put its mouth round my finger and then let go without attempting to use its teeth. This is the only snake I have ever known to do this.

Streep Slang. This snake, whose specific name is *crucifer* (or cross-bearer), is well named, for it bears a double cross (or at any rate a cross with 4 instead of 2 arms) on its neck. It is light grey in colour with three dark stripes running the length of its back. The underside is yellow with a white border. It is classified with the back-fanged snakes and must therefore be reckoned as poisonous; there is little or no fear of an accidental bite from it as it is one of the most timid of our snakes and will always do its best to escape. Its chief food consists of lizards, snakes and frogs. Found all over the Cape Peninsula.

Striped Skaapsteker.

Closely resembling the *crucifer* is the Striped Skaapsteker; in fact take away the cross, and 19 out of 20 would mistake it for the rarer Striped Skaapsteker, whose habits and distribution are practically the same.

Mottled Skaapsteker.

I hesitate to say it, but I cannot help feeling a sort of resentment against the Director of the Port Elizabeth Museum for his discovery that my favourite snake is not so harmless as he was supposed to be. The Skaapsteker is one of the most docile of our snakes. It is certainly classified as slightly poisonous, but I have never known it to harm a human being. I do not mean that it does not bite at first, but I feel certain that either its poison is not very strong or that it does not use its poison on us. And I do know, from experience, that it is almost impossible to get it to bite after it has once got used to being handled. It does well in captivity and soon learns to drink milk and water—pure milk seems to disagree with most snakes. By the way, it may come as a surprise to many to hear that snakes as a rule have to be *taught* to drink milk. Skaapstekers are found all over the Peninsula.

Black Mole Snake.

This non-poisonous snake is fairly common on the Flats. As its name implies, it is rather partial to a diet of moles—to which may be added mole-rats (or potato-moles), rats, mice and even birds. Although non-venomous the bite of a mole snake is rather dangerous, as it has a habit of tearing the flesh; I bear a couple of scars, each well over an inch and a half in length, on my right hand—the result of teasing a large mole snake. The wound was bad enough to cause me (at that time a young man of 22) to faint.

The young mole snake is not black but grey-green with dark blotches as it were showing through the skin. It would scarcely be recognised as a mole snake at all.

The mole snake makes a very docile and—here I pause—affectionate pet.

Black Water Snake.

This snake, though it frequently enters the water and is always found near water, is not a true water snake. Its main diet is frogs and tadpoles. In colour it is a very dark green, almost black on the back, and the underside is yellow. Its power of constriction is marvellous, and if, instead of a couple of feet, it were to grow to a length of 10 ft. with strength in proportion it would prove a match for an average man. Kept along with other snakes it proves a nuisance, as it does not care for the company of strangers and soon crushes them to death. Although non-poisonous it is not a nice snake to handle, as it has disagreeable habits and the smell seems to linger even after washing one's hands with soap and water.

Brown Water Snake.

The Brown Water Snake, which also is not a water snake (in fact it is often found far from permanent water) is even more offensive to handle. Like the Black Water snake it is fond of frogs, toads and tadpoles. It is a reddish or greyish brown in colour with a yellow underside bordered with a greyish-blue. It derives its Dutch name of "Tabak Rol" from the fact that when alarmed it rolls itself up, just like a roll of tobacco. So far I have not been able to find a reason for this habit unless it thereby hopes to resemble a stick or else something too large to swallow. Fairly common all over the Peninsula. Length about 9 ins. to 12 ins.

Egg-Eater.

The Egg-Eater is a light grey (or brown just before casting the skin) snake with a number of brown V's on the neck and brown spots or blotches down the back. It is one of the harmless snakes and, as may be inferred from its name, is very fond of eggs. The method of eating is very interesting. The egg is swallowed whole—not pierced and sucked—and when it is well down the throat the shell is pierced by a special set of teeth, which are really processes of the backbone and are tipped with enamel (or whatever takes its place in the teeth of snakes). The snake now swallows the contents of the egg and, after neatly folding the empty shell so that it looks somewhat like a boat, it ejects this through the mouth.

This snake "hisses," if I may use the term, by rubbing its sides together, when the rough scales produce a continuous hissing sound such as might be made by rubbing the tips of the fingers with a circular motion on this page.

Lamprophis Aurora or Nachtslang.

This snake, although not uncommon in certain localities on the Flats, is seldom seen on account of its nocturnal habits. In colour it is a golden green with an orange stripe bordered by yellow, running right down the back; underside mother-of-pearl. It is classified among the non-venomous snakes. Length about 2 ft. It used to be very common on the Claremont Flats, but it is now about 15 to 20 years since last I secured a specimen.

Lamprophis Inornata.

It has a relative which is one of the rarest snakes in the world — *Lamprophis inornata* — of which I believe there have been less than 20 specimens recorded. I was lucky enough to rediscover this snake when there was only one known specimen. Found on Wynberg Hill.

Earth Snake.

A snake seldom seen is the Earth Snake (not to be confused with the fairly common sand-snake, which is really a lizard). It is "earthworm pink" in colour. Found under stones; eats ants' larvae and eggs. It has the

power of burrowing very quickly in soft earth. The head, which bears two small "pin-point" black eyes, is armed with a shield on the snout; this shield being of extreme use in burrowing. The tail, which appears to have been "docked" ends in a little downward hook which must be of great assistance when the snake wishes to retire backwards in a hurry. Length 8 ins. to 10 ins. Found near Kommetje.

Thread Snake. A slender black snake with tiny white specks all over the body. Which end is its head? How can you tell which is its back? These two questions tell even more than a long description would do. Found all over the Peninsula. Feeds on ants' eggs.

Sea Snake. The Sea Snakes are all very deadly. Death is instantaneous. This snake, which rarely visits our shores, is really a native of the Indian Ocean and is sometimes brought by the current into False Bay. Between 1893 and the present time I have seen only three Sea Snakes, all dead on the beach at Muizenberg. I do not think it ever visits the cold Table Bay. I mention this because of the "See Slang" which is frequently caught by persons fishing at the Breakwater—this "See Slang" is really the Hag Fish.

The sea snake is a dark green on the upper and a light yellow on the lower half of its body. The tail is flat and spotted yellow and black.

Treatment of Snake Bite.

All our lizards are non-poisonous, so beyond sucking the wound, if they should happen to draw blood, no further treatment is necessary.

All who ramble on mountain and veld should be provided with :—

(*a*) Two pieces of strong string each about a yard long;

(*b*) a small supply of permanganate of potash;

(*c*) a small lancet, or else a pocket knife with a reserve blade, kept specially sharpened to a lancet point;

(*d*) quick wits—a good supply.

In case of a bite the first thing to do is to stop the flow of the poisoned blood to the heart. If you have a companion with you it is his duty to use the string; you must immediately grasp the limb just above the wound, and grip tightly. Your companion then winds one of the pieces of string around the limb just above your hands, getting tighter at each revolution; this done he winds the other piece of string at some distance above the first piece. In the meantime the injured person first wipes (with, say, his sleeve) the wound, taking care to move in the same direction as the snake's head was pointing when it bit. In other words pretend that your arm is the snake, and let it travel the same way as the snake would have done if it had simply crawled past or over the injured part. The reason for this is: the fangs of a snake are not hollow to the very point or they would be blunt, besides which a small portion of the victim's flesh would enter the fang and act as a stopper. Now the opening is in front of the fang, and there is just a chance that the snake in his fury may have ejected some of the poison before the fangs were properly driven home, and by wiping this poison away you may, without knowing it, do all that is really necessary on this occasion to save the life of the person. But, to continue; having wiped the wound, the next thing to do is to suck hard, and do not worry about that hollow tooth in your mouth—suck hard, and spit. Suck until you feel that you have sucked the place dry; then with your lancet make two deep incisions, along, not across, the muscle; suck again till you have sucked all the blood out, and then, when you are certain that you cannot get another drop of poison-laden blood out, put a couple of crystals of permanganate of potash into the wound: press them in, and now you must not suck any more. The time taken in tying up and cutting must be reckoned in seconds, or rather in fractions of a second as every instant gained or lost may make all the difference between life and death. (It is well to practice the tying-up part until you become adept at speed work. Get a friend to touch you unexpectedly with a stick, and say: "That's a bite." You then see how quickly you can get the place ready for cutting. Thus if you *do* happen to be bitten you will do the correct thing without stopping to think about it.) But our patient is waiting for further treatment. If there be someone else in the party he will, whilst the treatment was going on, have made a brew of strong, very strong, tea—put a handful of tea in the kettle and boil it. The patient must be kept warm and must not be allowed to sleep. Use a small twig as a switch if necessary. The next step is to get him to the nearest doctor, who, if possible, should be warned by telephone. The snake should be killed and taken along for identification if possible.

Spirits, if used at all, should be given very sparingly—teaspoonful doses—as alcohol tends to quicken the action of the heart for a time, but a period of depression follows and this is not desirable.

Warning.—If the flow of blood to a wounded limb be stopped for any considerable time mortification of the part is liable to set in; therefore the ligatures must be slackened for a second or two at the end of about 20 minutes. This must afterwards be repeated at intervals of not more than 15 minutes. Should breathing threaten to cease, artificial respiration must be resorted to.

Note.—A useful lancet specially invented for use in such cases can be purchased from any chemist, price about 1s. 6d.—but buy the wooden article, which can be smashed open if the screw jams.

Cyril J. French.

Boys' High School,
Wynberg.

LETTER TO THE EDITOR.

THE BIRDS OF KIRSTENBOSCH.

SIR,—In Part V. of the journal a short account was given of the 34 species of birds I had seen or heard at Kirstenbosch. I have since been able to make several additions to that list, bringing the total number of species recorded for Kirstenbosch to 43.

Of the nine new records four are to be found only during the summer months, viz., the Steppe Buzzard, about the same size as the Jackal Buzzard, but in colour a much lighter brown; the European Swallow, with a rufous chin and throat; the White-throated Swallow, with a white chin and throat and black chest-band; and the Stripe-breasted Swallow, with the rump a reddish brown. The remaining five species are residents. Of these the Sombre Bulbul or "Piet" (*Andropadus importunus*) is extremely common at Kirstenbosch, but very rarely does he show himself. It is his loud clear call "Piet! what-you-doing-here?", from somewhere in the trees, which betrays his presence. The dull green colouring of the upper surface and olive-grey of the lower harmonise well with his surroundings.

His relative, the Cape Bulbul or Kuif Kop (*Pycnonotus capensis*) is about the same size, 8½ inches, and can easily be recognised by the white ring round the eye and the curious metallic note. He is not nearly so common at Kirstenbosch.

In the ledges of the lower krantzes of Castle Rock the Speckled Pigeon or Rock Dove roosts. Coming down Nursery Gorge towards evening one is almost certain to hear their cooing, and to see some of them returning from their feeding-grounds. They are about 13½ inches long, and the general colour is grey and pinkish-brown above and grey beneath, the feathers of the wing coverts being tipped with white, which gives the speckled appearance.

Flitting about among the bushes and only seen very rarely, chiefly near the swamp above the Orchid Garden, is the Grey-backed Grass-Warbler, only 5 in. in length. The crown is rufous fading into ashy brown on the nape and back, and rufous-brown on the tail, the under-surface being dirty white with a few brown streaks on the sides.

Also flitting about among bushes, but in search of seeds and not insects, one occasionally sees and hears the Cape Canary or Seisje, perhaps the sweetest of the South African songsters. It is greenish yellow above, mottled with dusky and brighter yellow beneath, with the lower abdomen whitish, the female being browner above and paler yellow below.

There is no doubt that careful observations will add considerably to this record of the very interesting avi-fauna of Kirstenbosch.—I am, Sir, etc.,

BIRD-LOVER.

SOME RECENT PUBLICATIONS.

Age and Area.

The recent revival of interest in the geographical distribution of plants over the surface of the globe is largely due to the work of Dr. J. C. Willis, formerly Director of the Royal Botanic Gardens at Peradeniya in Ceylon. In a series of papers published during the last eight years he has elaborated a hypothesis, which he has recently expanded into book form under the title of "Age and Area" (Cambridge University Press, 1922, 14s.). The idea put forward is, briefly, that the older a species is the more time it has had to spread, and the greater area it will cover. Stated thus baldly, the idea is both obviously true and obviously inaccurate. A species *A* may have originated 500 years ago, and yet may occupy an area much greater than *B*, which sprung into existence by mutation 5,000 years ago. *A* may have a much more efficient dispersal-mechanism than *B*; or *A* might have arisen in Central Africa, with easy dispersal on all sides, while *B* might have arisen on St. Helena and might never have been able to get away. The problem as concerns individual species involves so many local and individual peculiarities, that any such rule as that stated above is untenable. But when we examine groups of allied species and strike averages, we find that Willis's Law of Age and Area is of real applicability. The rule, as most recently expressed, is as follows: "The area occupied at any given time, in any given country, by any group of allied species at least ten in number, depends chiefly, so long as conditions remain reasonably constant, upon the ages of the species of that group in that country, but may be enormously modified by the presence of barriers such as seas, rivers, mountains, changes of climate from one region to the next, or other ecological boundaries, and the like, also by the action of man, and by other causes."

The theory carries many surprising implications. Such plants as *Serruria florida* (of which about 100 specimens are known in the wild state), and *Priestleya Thunbergii* (of which only 5 specimens apparently exist), and which Kirstenbosch is "saving from extinction," may in reality be newly-arisen species, with no time yet to spread far, and with a destiny like that of rhenoster-bush or sow-thistle! Then again, what becomes of "adaptations"? Is *Erica cyrillaeflora* so specially adapted to the conditions in its one or two swamps on the Simonstown Mountains that it can live nowhere else: or has it simply not had time to spread to other swamps apparently as suitable? Questions of this kind and many others are discussed in a fresh and stimulating way in Dr. Willis's valuable book, which has put new life into the hopelessly overwhelming array of facts which composed the old science of geographical distribution.

School Gardens.

The value of school gardens in a broadly educational sense is being more widely recognised every day. They take the scholars into the open air and they bring them in personal contact with actual reality in a way which the abstract teaching of the classroom so often fails to do. They are the surest means of learning what the plants are and do, and at the same time of learning how to provide for their varying needs. And yet, how few school gardens there are in South Africa. In this country of flowers, vegetables and fruits, how few school children know the simplest rudiments of how to cultivate them. In this country of unequalled botanical wealth, how few schools have even a small nature reserve.

Of course, the establishment of a school garden involves certain difficulties—untrained teachers, lack of funds, control during holidays, lack of space, overcrowded curriculum and so on; and it is easier to keep the children's noses glued to their slates than to give them tools and seeds and let them grow something. But for those who think that school gardening is worth while, but do not know how to set about it, we can strongly recommend a perusal of a recent booklet issued by the English Board of Education, entitled "The Botany Gardens of the James Allen's Girls' School, Dulwich" (London: H.M. Stationery Office, price 2s.). It is the record of an experiment begun in 1896, and apparently the first of its kind among the English Secondary Schools. The authoress says "Our main object in developing the gardens has been to make the teaching of botany thoroughly practical by closely associating indoor with outdoor work. At an early stage we abandoned the use of text-books; the girls are taught to make their own. They study the structure of plants from actual specimens and the plant as a living thing, by their own experiments." As a result of gradual development, the gardens now comprise various ecological types—a pond, a lane, a sand-dune, a salt marsh, a heath, an oak wood, a peat bog, and so on: there are vegetable plots, areas for experiments in pollination, climbing plants, photosynthesis, etc., and a series of beds for a study of the natural orders. Conditions are, of course, quite different from—and in many respects more difficult than—those in many schools in South Africa, but this attractive and well-illustrated record of an actual school garden, will be found suggestive and encouraging to many in this country who are interested in establishing similar outdoor educational opportunities here.

* * *

Bush Fires.

Miss M. R. Michell, of the Botanical Department of the University of Cape Town, has recently published a short paper (Transactions of the Royal Society of South Africa, X. p. 213, 1922), in which she records the results of a careful study of the effects of a bush fire which took place on the slopes of Signal Hill, Cape Town, on 5th February, 1919. This is apparently the first time that observations of this kind have been made systematically, and their interest from the botanical as well as the public point of view, is enormous. Only by such studies can we hope to answer the many questions that arise in connection with bush fires, and it is greatly to be hoped that Miss Michell will be able to continue her work on this subject. In the present paper she deals chiefly with the composition of the flora and the plant succession following burning: but two points of great importance from a public point of view may be quoted. One is that rhenoster-bush is clearly favoured by burning. A succession of fires might lead to the almost complete substitution of rhenoster-bush for the more varied vegetation natural to the site; as indeed seems to have happened in many localities in the south-west Cape. The other noteworthy result is that "the removal of the vegetation by the fire helped the process of soil erosion. This process was also aided by man and cattle. Several small washaways occurred on the area subsequent to the fire." The importance of this observation should need no emphasis. It is not too much to say that on it depends the whole future of the south-west and coastal districts of the Cape Province.

New Members of the Botanical Society.

The following is a list of the Members and Associates of the Botanical Society who joined since the publication of the last list in the Journal, 1922.

(LIFE MEMBERS: FAMILY MEMBERS: Ordinary Members: *Associates.*)

Arnot, Miss.
Auerbach, Mr. and Mrs.
Barlow, Walter.
Bennett, A.
Britten, Miss L. L.
Brydone, R. R.
Conradie, Mrs. D. G.
Denham, Mrs. H. A.
De Villiers, A.
De Villiers, Mrs. Ben.
De Villiers, Senator.
Diep River School.
Donovan, Captain.
Goldie, Miss.
Gonzaga, Sister A. M.
Goodman, Mrs. Gwelo.
Hermann, Dr. Ch.
Heywood, Mrs. J. C.
Hind, W.
Hunter, S. J.
Johnston, W. S.
Jones, Mrs. F.
Jones, H.
Joubert, Miss S.
Kisch, Miss M.
Knight, Herbert.
May, A. G.
MAYTHAM, A. A.
McDonald, Mrs.
Moss, Miss D.
Neethling, Mrs. T.
NEWBERRY, MRS. E. M.
Pegler, Miss A.
PETERSEN, J. D.
Reid, Miss J.
Rothmann, Mrs. M. E.
Saunders, Lady K. S.
Saphra, Mrs. B.
Schofield, J.
Skaife, Dr. S. H.
Smith, Mrs. A. J.
Smith, Mrs. Hugh
Thomson, Hamilton.
Van der Sterr, W. C.
White, Rev. R. L.
Williams, Miss.
Williams, Alpheus.
Wolthuys, Verbeek, J.J.
Wylie, Brig.-Gen. J. S.
York Road School, Wynberg.

The Collection of Specimens for Kirstenbosch.

MEMBERS of the Society are invited to assist in stocking the Gardens with native plants. Specimens from all parts of Africa are desired. At present representatives of the following are particularly needed: *Aloes, Bulbs, Ferns, Proteas* (seeds), *Heaths* (branches bearing old flowers), *Succulents, Woody Leguminosae,* medicinal, aromatic and other economic plants.

From places within the Union (including S.-W. African Protectorate) consignments can be sent free by rail (S.A.R. and N.C.C.R.) or post if addressed:

BOTANICAL SPECIMENS, O.H.M.S.

To

THE DIRECTOR,

National Botanic Gardens,

Kirstenbosch,

Newlands, Cape.

From Northern and Southern Rhodesia seeds and plants may be sent by post at Sample Rate, without preliminary inspection or fumigation. From Southern Rhodesia plants travel by rail at half-rates as far as Mafeking, and thence free to Kirstenbosch.

INSTRUCTIONS FOR PACKING AND SENDING SPECIMENS.

Cotyledons, Crassulas, Euphorbias, Aloes, Stapelias Mesembrianthemums and other plants of a like succulent nature, and also the *Epiphytic Orchids,* should be packed dry. Each species should be wrapped in paper and laid tightly in a box. Large specimens of *Aloes, Euphorbias, Cycads,* etc., may be trucked loose.

Large specimens of Tree Ferns should be bound in wet grass or canvas, or with a little damp moss inside the canvas, and the stems should be strengthened with poles.

Ferns, Bulbous and Tuberous Plants in growth and flower need a little damp moss among the roots.

Distinct species of dormant bulbs and tubers, as well as of seeds, should be sent in separate wrappers.

Each consignment should bear (1) the name and address of the sender; (2) the locality in which the specimens have been gathered. Brief notes as to habitat (wet, dry, sun, shade, sand, clay, and so on) are most valuable.

Contributors of economic plants are requested to send particulars as to their properties and the methods of using them.

Common as well as rare species will be welcome. Fully addressed labels can be had on application

THE BOTANICAL SOCIETY OF SOUTH AFRICA.

ANNUAL REPORT, 1922.

THE Council has pleasure in submitting the tenth Annual Report of the Society.

MEMBERSHIP.—The membership of the Society stands at: Life Members, 55; Family Members, 52; Members, 418; Associates, 301; total 826, as compared with 795 in 1921.

ANNUAL GATHERING.—The Annual Gathering at Kirstenbosch was held on Saturday, November 25th, and was well attended by members and their friends. Our thanks are due to Mrs. Compton for undertaking the duties of the Hon. Secretary during the latter's disablement, as well as to those women who so kindly gave a helping hand at the tea, most of which was so generously provided by various members and others.

COUNCIL MEETINGS.—Three meetings of the Council have been held during the year.

ANNUAL GENERAL MEETING.—At the Annual General Meeting, held on April 25th, the following officers were elected for the year:—

President: The Right Hon. Sir James Rose-Innes, P.C., K.C.M.G.

Vice-Presidents: Sir Lionel Phillips, Bart., the Hon. Sir Lewis Michell, C.V.O., and Mr. Max Michaelis,

Members of the Executive Council: Mr. W. Duncan Baxter; Mrs. F. Bolus; Mrs. Carter, C.B.E.; Mr. F. E. Cartwright: Senator the Hon. F. F. Churchill; Professor R. H. Compton; Mr. W. A. Eaton; Miss Fairbridge; Mr. W. Greenacre, M.L.A.; Mr. P. S. Horne; Lady Rose-Innes, C.B.E.; Mr. H. T. Twentyman-Jones; Mr. W. de N. Lucas; Mr. A. H. Reid; Miss E. Struben; Professor D. Thoday; Mr. A. Walsh; Mr. W. Webber, M.L.A.; Miss F. M. White; Mrs. H. S. van Zijl.

At the first meeting of the Council Mr. W. A. Eaton was elected Chairman for the year; Mr. H. T. Twentyman-Jones, Hon. Treasurer; and Mrs. F. Bolus, Hon. Secretary.

JOURNAL.—The Journal of the Society was published in July, and was edited by Professor Compton, to whom the Council tenders its appreciation and thanks.

BOTANY RAMBLES.—The Botany Rambles instituted by the Society have been conducted throughout the school year by Mrs. Bolus, Miss Johns and Miss Moss, and have been much appreciated. The total number of attendances was 1,126 as compared with 1,128 in 1921. These rambles are now being conducted by Miss Starke, who has been appointed by the School Board to do this work. The appointment is the result of representations made by the Society through Lady Innes to the Superintendent-General of Education, and is the most satisfactory culmination of the Society's efforts in this direction that could be desired.

VACATION COURSES.—Two vacation courses in Botany and Nature Study have been conducted under the auspices of the Society by Mrs. Bolus, viz., one in January of three week's duration, and one in September of two week's duration. These were attended by a total of 23 students as compared with 39 in 1921.

INFORMAL GATHERINGS.—An informal gathering was held on April 8th, when Mr. Mathews gave an interesting demonstration in seed-sowing. After the demonstration a number of Euphorbias were planted by various members in the recently made Karroo Garden.

OBITUARY.—The Council records with deep regret the loss it has sustained in the death of Mr. A. H. Reid, who has served on the Council since its inauguration in 1913.

FINANCIAL.—The audited Financial Statement accompanies this Report, and from this it will be seen that the sum of £460 10s. 7d. has been available for the purpose of augmenting the funds of the National Botanic Gardens as compared with the sum of £491 7s. 5d. in 1921. During the last financial year and in response to special efforts made by Mr. Cartwright on behalf of the Society, the following additional sums were contributed, viz., £200 by Sir Lionel Phillips, £100 by the Divisional Council, £50 by Mr. W. Duncan Baxter, and £1 1s. by "A Friend"—total £351 1s. The Council desires to express its grateful acknowledgments to these generous donors.

APPEAL FOR NEW MEMBERS.—The Council again takes this opportunity of reminding the members of the objects of the Society. One is, the practical help to the National Botanic Gardens. In these times of depression it is more than ever necessary to give all the help one can, and the best means of doing so is to induce those who have not already joined to become members of the Society. The interest and help of members are earnestly solicited.

N.B. (1) Life Members, £25. (2) Annual Members: Family Members, £2 2s.; Ordinary Members, £1 1s.; Associates, 5s.

The Council has to express its indebtedness and hearty thanks to Mr. R. L. McDonald for auditing the accounts; to the City Council and the South African Association for the use of rooms for meetings; and to the Press for valuable assistance in reporting matters of interest.

W. A. EATON, *Chairman.*

L. BOLUS, *Hon. Secretary.*

BALANCE SHEET AS AT 31ST DECEMBER, 1922.

Liabilities.				Assets.			
Life Members Reserve Fund	£655 0 0			Fixed Deposit—			
Added during year	25 0 0			Treasury Bill	£500 0 0		
		£680 0 0		Accrued Interest	7 18 2		
Subscriptions paid in advance		19 14 0				507 18 2	
Sundry Creditors		2 19 9		Cape of Good Hope Savings Bank	100 0 0		
Kirstenbosch Special Fund		1 5 0		Accrued Interest	11 12 4		
National Botanic Gardens—						111 12 4	
Surplus for year	460 10 7			Investment Account—			
Less Amount paid	300 0 0			Union of S.A. 5% Loan 1929-39, at cost	100 0 0		
		160 10 7		Accrued Interest	1 9 4		
						101 9 4	
				Cash at Bank		143 9 6	
		£864 9 4				£864 9 4	

REVENUE AND EXPENDITURE ACCOUNT FOR 12 MONTHS ENDED 31ST DECEMBER, 1922.

To Bank Charges	£1 4 9		By Subscriptions—			
Gathering of members at Kirstenbosch	8 9 9		Ordinary	£385 12 0		
General Expenses	25 11 6		Family	84 0 0		
Stationery, Printing and Advertising	14 14 0		Associate	50 6 0		
Journal Account	48 2 3				519 18 0	
Amount paid over to Trustees, National Botanic Gardens, Kirstenbosch	351 1 0		Interest		37 16 4	
Balance—Surplus	460 10 7		Sale of Panorama Views		0 18 6	
			Amounts collected for Kirstenbosch Gardens		351 1 0	
	£909 13 10				£909 13 10	

((Signed) W. A. EATON, *Chairman.*

(Signed) H. T. TWENTYMAN JONES, *Hon. Treasurer.*

Cape Town,
18th January, 1923.

Audited and found correct.

(Signed) R. L. MCDONALD,
Hon. Auditor.

Cannot Members of the Botanical Society, through their efforts, celebrate the Society's tenth birthday by making its membership one thousand ?

The Botanical Society of South Africa.

OBJECTS:

(*a*) To encourage the inhabitants of South Africa to take an active part in the progress and development of the National Botanic Gardens at Kirstenbosch, a part of the Groote Schuur Estate, in the Cape Province, and to induce them to appreciate their responsibilities therein.

(*b*) To augment the Government grants towards developing, improving, and maintaining fully equipped botanical gardens, laboratories, experimental gardens, etc., at Kirstenbosch.

(*c*) To organise shows at which may be displayed the results of botanical experiments or cultural skill in improving the different varieties of South African flora.

(*d*) To enlighten and instruct the members on botanical subjects by means of rambles, meetings, lectures, and conferences, and by the distribution of literature.

FOUNDED JUNE 10th, 1913.

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THE RIGHT HON. SIR JAMES ROSE-INNES, P.C., K.C.M.G.

Vice-Presidents:
SIR LIONEL PHILLIPS, BART.
HON. SIR LEWIS MICHELL, C.V.O.
MAX MICHAELIS, ESQ.

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Honorary Treasurer: H. T. TWENTYMAN JONES, ESQ. (P.O. BOX 127, CAPE TOWN.)

Honorary Secretary: MRS. F. BOLUS (P.O. BOX 70, CAPE TOWN).

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Mrs. F. Bolus.
Mrs. Carter, C.B.E.
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Prof. D. Thoday.
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A. Walsh, Esq.
W. Webber, Esq., M.L.A.
Miss F. M. White.

Terms of Membership:

Life Members, subscribing not less than £25.

Family Members, subcribing not less than £2 2s. per annum.

Members, subscribing not less than £1 1s. per annum.

Associate Members, subscribing not less than 5s. per annum.

Associate Members enjoy all the privileges of Membership except that they do not vote at any of the Society's Meetings.

Honorary Members may be elected at a Meeting of the Society on the nomination of the Council.

Those wishing to become Members of the Society are invited to communicate with Mrs. F. BOLUS, Hon. Secretary, P.O. Box 70, CAPE TOWN.

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OF SOUTH AFRICA

Edited by R. H. COMPTON, M.A., F.R.S.S.Af., Hon. Director, NATIONAL BOTANIC GARDENS :: :: :: KIRSTENBOSCH :: :: ::

Part X. 1924

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Cambridge University Press

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Crinums at Kirstenbosch.

The Journal of the Botanical Society of South Africa

PART X 1924

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Bees and Wasps of Kirstenbosch. Drawn by S. H. Skaife Plate II

South African Rutaceae. Drawn by Miss M. M. Page Plate III

News and Notes.

THE FOLLOWING TABLE shows the Membership of the Botanical Society of South Africa for each year since its foundation:—

	Life	Family	Ordinary	Associates	Total
1914 ..	.. 33	22	264	33	352
1915 ..	.. 46	26	263	32	367
1916 ..	.. 49	26	264	45	384
1917 ..	.. 46	24	249	53	362
1918 ..	.. 49	28	281	78	436
1919 ..	.. 50	38	320	84	492
1920 ..	.. 54	45	384	237	720
1921 ..	.. 54	48	407	287	795
1922 ..	.. 55	52	418	301	826
1923 ..	.. 59	50	405	269	783

It is satisfactory to observe that the number of Life Members has again increased. The other classes show a decrease of numbers but this is largely due to a recent drastic overhauling of the list by the Hon. Treasurer, and does not indicate any real falling off in the Membership.

* * *

The full list of names of Members and Associates of the Botanical Society is published in the following pages. This was last done in 1921. In the 1922 and 1923 Parts of the Journal the names only of newly-joined Members and Associates were printed.

* * *

The Government has placed an amount of £1,400 on the Estimates for 1924-25, as a grant towards the erection of a Hostel at Kirstenbosch. It will be remembered that a similar grant was voted four years ago, but owing to the high cost of building at that time it was impossible to proceed with the work, and the grant lapsed. There is now every prospect of it being possible to erect the Hostel with the renewed grant together with the sum available in the Pearson Memorial Fund.

* * *

A plan for a Tea House at Kirstenbosch has been drawn by Messrs. Walgate and Elsworth, and tenders have been obtained for its erection. A sketch of the building was published in the "Cape Times" of 4th Feb., 1924, together with a description of the building, a subscription list and an appeal for a further amount of £327 for fittings and equipment. Part of this has already been subscribed, and it is greatly to be hoped that the Trustees will be able to authorise the erection of the building at an early date. Subscriptions should be sent as soon as possible to Mr. F. E. Cartwright, P.O. Box 45, Cape Town, who is acting as treasurer of the funds.

* * *

A public telephone call-office has been installed at Kirstenbosch, adjoining the site of the new Tea House. Hitherto the nearest public telephone was nearly three miles away, and the new installation will meet a long-felt want.

* * *

The University of Cape Town is erecting a building to house the Bolus Herbarium and Botanical Library on a site handed over to the Council of the University by the Trustees of the National Botanic Gardens. The site is an area of about two acres adjoining the Bishopscourt boundary on the north slope of Wynberg Hill Ridge, at an altitude of about 400 feet above sea level. The building will be high and dry and should be free of dust: and a magnificent view is obtained across the Gardens to the Mountain and the distant hills and ranges. The architects are Messrs. Parker & Forsyth, and the builders Messrs. Bakker Bros. of Claremont.

The funds for building are provided by the will of the late Dr. Bolus, the founder of the Herbarium. The juxtaposition of the Gardens and the Herbarium will greatly increase the mutual profit of both institutions, and will render Kirstenbosch the most important centre of systematic botany in South Africa.

* * *

The Karroo Garden at Whitehill, which has been carried on during the past three years entirely without funds, is now likely to be placed on a more secure and hopeful basis. Two benefactors have come forward and guaranteed £120 a year for five years towards the development of the Karroo Garden. It is estimated that about £230 a year for five years is necessary to set the Garden on a sound footing. Any gifts in pursuance of this object will be gratefully welcomed, and should be sent to the Director, Kirstenbosch. All who have seen Whitehill are impressed with the possibility of establishing there a unique collection of the marvellous succulent flora of South Africa. One of the above-mentioned donations is liable to be withdrawn if insufficient support from other sources is not quickly forthcoming to enable development to proceed. Therefore, *bis dat qui cito dat.*

On December 9th a good-sized party, organised by the Mountain Club, performed the ceremony of "beating the bounds" of the Upper Kirstenbosch Nature Reserve. Starting from Fernwood Peak the party located all the beacons (except one which had disappeared) on the mountain top, and added notably to their size. The interest that the Mountain Club is taking in the new Nature Reserve is a happy augury for its future.

* * *

Fireplaces have now been constructed at various points in the gorges in the Upper Kirstenbosch Nature Reserve, with the object of localising picnic fires in safe spots. It is noteworthy how many bush fires start on Saturdays and Sundays, and these are probably due chiefly to careless campers: the new fireplaces should materially lessen this risk as far as Kirstenbosch is concerned

Notice boards have also been erected at the top of the principal paths leading down through the Reserve: these ask the co-operation of the public in refraining from flower-picking and promiscuous fire-making in the Reserve. An attempt is also being made to get rid of the cluster-pines, hakeas and wattles which have been spreading so rapidly on the open slopes; and of some of the scattered oaks in the indigenous forest of the ravines

* * *

On 28th February, 1924, His Excellency the Governor-General, Her Royal Highness Princess Alice, Countess of Athlone, and Lady May Cambridge, visited Kirstenbosch. They were met and escorted round the Gardens by Mr. and Mrs. Duncan Baxter, Sir Ernest Kilpin, the Direc- and Mrs. Compton and Mr. Frank Cartwright. A bouquet of choice heaths cultivated in Kirstenbosch was presented to Princess Alice by little Phyllida Compton. The visit occupied nearly two hours, during which many of the principal features of the Gardens were inspected.

* * *

Among recent visitors to Kirstenbosch from overseas were Lord Lambourne, President of the Royal Horticultural Society; the Countess Russell, author of the "Elizabeth" books and many other novels and plays; the Baron and Baroness Rudolf de Goldschmidt-Rothschild; and Mr. Arthur K. Bulley, whose garden in Cheshire enjoys wide fame, and who has been visiting South Africa in search of horticultural novelties.

* * *

The Harry Bolus Chair of Botany at the University of Cape Town, vacated by Professor Thoday, was filled last April by the appointment of Professor R. S. Adamson, M.A., of Edinburgh and Cambridge Universities, and formerly Senior Lecturer in Botany in the University of Manchester. Professor Adamson has a big reputation in Europe as an ecologist, and since his arrival in South Africa he has devoted himself with enthusiasm to the study of the vegetation of the Western Cape Province. He takes Professor Thoday's place on the Council of the Botanical Society.

* * *

The death in February of Dr. L. A. Peringuey, Director of the South African Museum, Cape Town, is a severe blow to scientific work, particularly on the zoological and anthropological sides, in South Africa. It is fitting that mention should here be made of his friendship for Kirstenbosch, and his keen desire to do all that he could to help in the progress of the Gardens. When the National Botanic Gardens Advisory Committee was established jointly by the Government and the Trustees at the end of 1921, Dr. Peringuey was the nominee of the Department of the Interior. He was unanimously elected Chairman of the Committee and presided at all of its meetings with enthusiasm. The Report of that Committee, issued in July, 1922, is a noteworthy summary of what has been accomplished at Kirstenbosch, and a far-sighted and progressive statement of policy for the future. It is sad that Dr. Peringuey should not have lived to see the fulfilment of the recommendations of the Committee, but financial conditions have up to the present prevented the Government from carrying out the advice of the Committee, except in one or two particulars.

* * *

A new garden of native plants has been founded at Kimberley, under the auspices of the McGregor Memorial Museum. A site in the Public Gardens has been handed over for this purpose, funds were provided by Mr. Alpheus Williams and others, and a rock garden has been laid out to accommodate the remarkable succulent flora of Griqualand West and of other districts of South Africa. Contributions of plants have been sent in by Mrs. Wallis Miss van den Berg, Mrs. Anderson, Mr. Sidney Tapscott and others. The new venture, with which the names of Miss Wilman and Mr. Walton Jameson must be coupled, deserves every success, and should be the forerunner of many such gardens in South African towns.

* * *

Certain much-needed reforms in the Cape Ordinance protecting wild flowers were recommended by the Wild Flower Protection Society to the Acting Administrator on 19th July, 1923, and were brought before the Provincial Council in August. Unfortunately opposition manifested itself, and it was necessary, in order to secure the passage

of the bill, to withdraw the proposed reforms. The matter is to be brought up again at the forthcoming session of the Council. The most vital recommendation is to empower the authorities to confiscate protected flowers exposed for sale — a power which, strange to say, they do not possess at present: the result being that the flower-seller can, and does, easily recoup himself for his fine by selling the remainder of his bunch.

* * *

Last year we recorded the decision of the Administrator's Department, in response to local demand, to prohibit all wild-flower picking in the division of Caledon; and we expressed the belief that this step would lead to a gradual restoration of the former glories of the district. Since then certain species of heath have been declared exempt from this restriction, without consulting the local society. A more serious step was later taken by the Department in issuing a circular instructing the Magistrate that "flowers which are protected from fire, pruned and weeded, and generally protected by farmers on whose property they grow, may be regarded as cultivated." As a writer in the "Cape Times" said, "the effect of this was to knock the bottom out of the whole thing. How are the police to know the cultivated from the uncultivated wild flowers? How can they know from what area they have been gathered?" An enormous traffic at once sprang up, and an appeal to the police to stop it proved abortive. "The reply to representations made was:— 'In face of the instructions we can do nothing.'"

It may be mentioned that the Department in issuing the circular, acted contrary to the opinion of the Committee of the Wild Flower Protection Society given on a deputation to the Acting Administrator last July. The situation can now only be rectified by a system of farmers' permits, labels and badges which will bristle with practical administrative difficulties.

* * *

We publish an article from the able pen of Dr. S. H. Skaife of the Cape Province Department of Education on the Bees and Wasps of Kirstenbosch: this being a continuation of the series of articles on the native fauna of the National Botanic Gardens printed in recent Parts of the Journal. Those who are familiar with the wonderful work of Fabre on the French wasps and their astounding habits will perhaps take a special interest in the parallel habits of their Kirstenbosch cousins — their strange and varied nest-building and their really diabolical methods of provisioning the nests for their offspring. Dr. Skaife has made a special study of the bees and wasps of Kirstenbosch, and all students of nature will owe him a debt of gratitude for his article with its accurate and elaborate illustrations.

* * *

Miss A. V. Duthie, Lecturer in Botany in the University of Stellenbosch, contributes an article on a group of organisms of rare fascination and interest, the Mycetozoa. Claimed by both botanists and zoologists, these strange forms of life are very near the primordial living substance from which animals and plants both took their origin. Mere naked masses of semi-fluid protoplasm, they stream slowly and deliberately over the ground or climb up trees and logs, engulfing their solid food, and eventually being converted into reproductive bodies whose definite shape and beautiful structure contrasts strangely with the amorphous creeping slime from which they, as it were, crystallised. Miss Duthie is specially qualified to write on this group, on which she is the first authority in South Africa. Kirstenbosch appears to be a very favourable place for Mycetozoa, and some species are frequent and conspicuous objects there.

* * *

Mrs. Levyns, Lecturer in Botany in the University of Cape Town, contributes a paper on the Rutaceæ with special reference to those which can be seen wild or cultivated at Kirstenbosch. This world-wide family, which includes all the citrus fruits, is represented in South Africa by numerous highly aromatic shrubs, often with charming white or pink flowers, among which the various buchus are familiar. It also includes one of the noblest of our native trees, the so-called Cape Chestnut, which has been planted in many parts of the world for the beauty of its dark foliage and its great trusses of flowers. A large number of Rutaceæ are to be seen at Kirstenbosch: the commercial buchus being planted on the large scale, and several other species of Barosma, Agathosma, Coleonema and Adenandra being grown as a key collection in the Economic Grounds: and there is also the young avenue of Cape Chestnuts. Various species also grow wild in the Kirstenbosch area. Mrs. Levyns' account of the family contains many original observations on the pollination and dispersal mechanisms. The plate is an example of Miss Page's beautiful work, so well known to members of the Botanical Society.

Mr. Mathews has added a short article on the cultivation of the Rutaceæ. Readers of the Journal are familiar with his writings on Buchu cultivation: and his present article extends the methods to cover the whole family.

* * *

An article from the pen of Miss Letitia Starke, the Teacher of Nature Study at Kirstenbosch, on the subject

of her own work with school children will be most welcome. Miss Starke writes as she works, *con amore*, and her readers will understand how such a subject with such a teacher can make the quarterly visit to Kirstenbosch one of the most eagerly anticipated events of school life in the Peninsula. Thus Kirstenbosch is playing its part in the education of young South Africa: and one may conjecture that the day at Kirstenbosch is of more real educational value than weeks of blackboard and bench: that the air of the mountain side is purer than that of the classroom: that intimate personal contact with living plants and animals is better than the abstractions of chalk and duster. One can only make one criticism, and that is that one day's nature study a term is hopelessly insufficient. Kirstenbosch is there to be made use of in this as in so many other ways: and our educational authorities are wasting a priceless opportunity if they do not take fuller advantage of it.

* * *

The Ferns of the Cape Peninsula are a little known group of rare beauty, all the greater for the contrast they present to the prevailing maquis or scrub of the open hillsides. Kirstenbosch is one of the richest areas in the Peninsula for ferns, and it is interesting to note that it has approximately as many species as the whole of the British Isles. A paper on the native ferns of Kirstenbosch and the Cape Peninsula is printed in this Journal, and the Curator of Kirstenbosch, Mr. J. W. Mathews, contributes one of his well-known articles on the cultivation of South African ferns. A magnificent collection of native ferns occupies the whole length of the Fern Dell, where shade, moisture and varied aspects provide numberless suitable situations for this most decorative class of plants.

* * *

It is now a hundred years since Burchell published his "Travels in South Africa", (1822-24), and it may be appropriate to quote what he says about Kirstenbosch (vol. 1 pp. 67, 68). Burchell paid his visit to the Wynberg Hill Ridge on 14th March 1811. He gives a short list of some of the plants he found, which are still noteworthy elements of the local flora. With what interest would he have learnt that, nearly a century later, "Kerstenbosch" was to be South Africa's National Botanic Garden and the site of a Nature Reserve!

"On taking leave", he writes "of Wynberg and its beautiful scenery, Dr. Glaeser and Mr Stockenstrom accompanied us a short distance, for the purpose of showing us a road from which I might have a view of Kerstenbosch; and, that I might take advantage of this opportunity to botanize over new ground, we went on foot, while two Hottentot soldiers led our horses. This road has been but newly cut through a pleasant coppice, containing a great variety of shrub, and many large silver-trees. Here I found several plants which I had never met with before.

"Our walk conducted us to a high part of the hill of Wynberg, which overlooks Kerstenbosch, a beautiful estate belonging to Government. The view from this spot, and indeed, all the scenery around, is the most picturesque of any I had seen in the vicinity of Cape Town. The beauties here displayed to the eye could scarcely be represented by the most skilful pencil: for this landscape possessed a character that would require the combined talents of a Claude and a Both: but at this hour, the harmonious effects of light and shade, with the enchanting appearance of the foliage in the foreground and the tone of the middle distances were altogether beyond the painter's art. The objects immediately surrounding us were purely sylvan: and the extent of distance terminated the landscape, both in front and on the right. To the left the noble Table Mountain rose in all its grandeur, crowned with rocks and displaying, in the broad ravines that descended its side, the rich colouring of some inaccessible woods, the growth perhaps of centuries. The enormous and lengthened shadow of Table Mountain and Devil's Mountain stretched far over the Flats, and seemed to touch the foot of Tygerberg. The last beams of the sun, gleaming over the rich, varied, and extensive prospect, laid on the warm finishing lights in masterly and inimitable touches."

It is with deep regret that we record the death of Miss N. de Jager, which took place in hospital on 16th March, owing to heart failure. Miss de Jager was Lady Warden of the Kirstenbosch Hostel for nearly five years, and carried on the arduous duties of the post with unfailing courage and ability. The difficulties of looking after a household so various as that which lived in the inadequate and unsatisfactory cottages which had (and still have) to do duty for a Hostel were enough to daunt anybody. Miss de Jager faced the difficulties, made the best of the accommodation for everyone, and came out on the right side financially. Never in robust health, her disposition was sensitive and retiring; but those who could penetrate behind her reserve knew her for a good and true woman, devoted to the Hostel and the Gardens, and eager to overcome troubles and make the best of an almost impossible position.

Progress at Kirstenbosch.

THE following summary of work done in the Gardens during 1923 is recorded for the information of Members of the Society who are unable to keep themselves acquainted with the progress by frequent visits to Kirstenbosch.

On the north side of the Lawn the brambles, poplar and scrub have been cleared, and the ground, about 2,000 square yards, trenched and planted with grass down to Skeleton Stream. Along this area, from the Terrace to Skeleton Bridge, an 8-foot path has been made with stone foundation and blinded with gravel. The water main has been re-laid along the path, and the branches lowered to enable the taps to be enclosed in iron boxes at ground level. Three gutters have been cobbled in cement to carry surface water from the path down to the stream. The Gerbera bed has been increased to 145 square yards, the plants divided and replanted to fill the new bed. The Leonotis have been lifted and planted in three masses on the bank of the stream. A bed of 290 square yards has been planted with 150 Podalyrias, and edged and filled up with Ursinias, Nemesias, and Dimorphothecas.

The Mesembrianthemum Bank has been extended into the field about 15 feet for its whole length, and planted with Mesembrianthemums and a few species of shrubby Crassulas. An 8-foot path has been cut out on the field side of the ground.

The summer-flowering Watsonias in the Dell have been lifted, divided, and over 2,000 replanted in larger masses and clumps. Sparaxis, Babianas, etc., have been lifted from various sites, and transplanted along the kerbs here and in the Pelargoniums. The Agapanthus have been lifted, divided and replanted on the north slopes, where large numbers of flowering plants and shrubs have also been planted. At the foot of the Dell the Vallotas have been lifted, the ground trenched, the large bulbs planted back, and the remaining space filled with masses of five species of Arums. At the back of the Bath the second flight of six steps and retaining walls have been built, and the platform cobbled.

There have been planted over 7,000 corms of Western species of Watsonias among the Cycads from the Office to the N.W. corner of the Amphitheatre. The remainder of the oaks around the Cycads have been cut down and stumps grubbed out. The Horse-Shoe Path, for the remaining 320 yards around the "brow" has been lined out, and the intervening area of about 1,600 square yards trenched and graded to natural slopes with soil from the pathway.

On the south side of the Aloe Kopje 80 square yards have been prepared and planted with the collections of Gasterias and Tulbaghias, with various shrubs and trailing plants between for shade and groundwork. A similar area adjoining has also been prepared and planted with the collection of Scillas.

An additional area of 1,500 square yards on the south side of the Horse-Shoe Path has been cleared of scrub and planted up with 680 Proteaceae, including several rare and showy Leucospermums.

The roadway from the back of the Cycads to Wynberg Gate has been lined out and the scrub cleared on 10 feet of its width.

About 1,200 seedling Heaths have been planted out in the Heath Garden, and 40 in the Swamp, where various moisture-loving Orchids and other plants have been placed.

The unoccupied ground below the Buchu has been trenched and sown mainly with Colocynth, and an area of 300 square yards sown with seed of selected forms of Buchu. A small stand of "Wax Berry" has been planted out. In the orchard large stands of seven varieties of scented-leaved Pelargoniums were planted out to supply material for testing their value as yielding "Oil of Geranium."

Two areas of about 600 square yards were prepared and planted with small stands of the varieties of Hops, with lines of Black Peppermint alternating.

The stumps of the old oak hedge on the permanent nursery site have been grubbed out, and the ground roughly levelled. A trench 2 feet by 3 feet has been taken out on the two open sides for hedges. The site is being enclosed with a barb wire fence, the standards being in position and five strands of wire fixed. Three beds 6 feet wide and each 50 yards long have been enclosed with small meshed wire netting to prevent moles gaining access, filled with prepared soil, and sown with many species of bulbous plants.

Water has been laid on to the Karroo Garden site from the reservoir near the Director's house, a distance requiring 288 yards of 1 inch piping, and branches totalling 210 yards with 8 taps, etc. A quantity of boulder stone has been split and brought down to the site.

A tool and work shed has been built in the bank between the Aloe Kopje and Dell. All walls are of stone procured on the site, and the roof of thatch.

A wood and iron cowshed has been built below Rhodes' Road, and a post and rail fence erected to form a paddock around it.

The Stables have been moved from their old site at the foot of the Fern Dell to the Paddock below Rhodes' Road. and the Forage Shed has been transferred from Window Stream gate to the back of the Stables.

J. W. MATHEWS.

Kirstenbosch,
February 1924.

South African Mycetozoa.

By MISS A. V. DUTHIE.

IN the summer time, shortly after rain has fallen, one often notices on old pine stumps large silvery-grey cushion-like growths some two inches or more across. (Fig. 1). These growths are the fruit bodies of *Reticularia Lycoperdon*, one of the Mycetozoa. When freshly formed they look rather like large blister pearls, but if the membranous outer covering of a dry cushion is broken, the interior is found to be filled with a dusty mass of threads and rusty brown spores. The fruit bodies of Reticularia are very abundant in the Cape Peninsula and have often excited the comment of visitors to our National Botanic Gardens. The general resemblance to the 'puff ball' fungi is very striking, indeed the specific name, Lycoperdon, is the name of a well known genus of true puff balls. But whereas the spore of the fungus gives rise on germination to a walled thread or mycelium the spore of Reticularia behaves very differently.

Germination

In order to watch the germination of the spores it is only necessary to place some in a drop of water on a glass slide, cover with a cover-glass and examine under a compound microscope. The wall of each spore is closely netted and thickened on the more rounded side, while the remainder of the wall is thinner and paler in colour. As the spore absorbs water it swells slightly, becomes more transparent, and finally the thinner part of the wall cracks and the colourless living substance or protoplasm protrudes through the ruptured wall. The emerging mass of protoplasm rapidly enlarges until, after the lapse of a few seconds, the entire living content of the spore escapes from the spore-coat with a slight jerk. The hatching of the spore is rather suggestive of a bubble forming and finally breaking away from the bowl of a bubble pipe. The spores of a freshly gathered fruit body will 'hatch' in fifteen minutes, but the time required for germination increases with the age of the spores. Once it begins the process goes on very rapidly and soon the drop of water is filled with the empty ruptured spore-coats and the transparent masses of protoplasm which have escaped from them. These 'protoplasts' or swarm-cells, at first spherical, soon become more irregular in outline and show creeping movements which may last for half an hour. Gradually each swarm-cell becomes pear-shaped and thrusts out a fine whip-like lash of protoplasm from the pointed end. With the development of this 'flagellum' the movement changes from the slow creeping one already observed to a dancing undulatory motion. A drop of water filled with a writhing mass of flagellate swarm-cells presents a very animated scene. As the water gradually evaporates from the edge of the cover-glass and finally dries up completely, it is wise to use a 'moist chamber' for more prolonged observations. This may be simply and easily made by fastening a small ring of glass, metal or rubber, to the surface of a glass slide by means of vaseline. The upper edge of the ring should also be smeared with vaseline and a little water dropped on the slide inside the ring. Some of the Reticularia spores are placed in a tiny drop of water in the centre of a clean cover-glass, care being taken to select a cover of the same diameter as the ring or somewhat larger. The cover-glass is now inverted over the ring and pressed down gently so that it adheres closely to the vaselined edge. The drop of water containing the spores will hang freely downwards and can be examined under the microscope without fear of its drying up. (Fig. 16). In this way we reproduce, in a manner suitable to microscopic examination, the moist conditions so favourable for the germination of the spores.

The swarm cells of Reticularia continue to show active movements for some days and then disintegrate. But there are other forms which will pass through the whole of their life cycle in the moist chamber just described. One of the commonest of these is *Didymium difforme*, which

forms small white egg-like sporangia on dead leaves and twigs. (Fig. 17a). The spores of specimens collected in Stellenbosch in 1916 germinated in November, 1923, but only after being immersed in water for two or three days. The actual hatching of the spores takes place far more slowly than in Reticularia and may occupy many hours. (Fig. 17b). To supply the swarm-cells with the bacteria on which they feed it is well to place a small scrap of the coat of a garden cress seed with the spores in the hanging drop. The swarm-cells, which multiply by division, finally withdraw their flagella, assume once again a creeping movement and gradually unite to form a large mass of naked protoplasm or 'plasmodium'. (Figs. 17c; 18). The plasmodium creeps slowly about in search of food, increasing in size and showing in its interior a rhythmic streaming movement of its more fluid substance which can be readily seen under the microscope. The plasmodium finally heaps itself up at one or more points to form the fruit bodies or sporangia.

All Mycetozoa pass, sooner or later, through the stages described above, which may be tabulated as follows:—

1. The walled spores of the fruit-body give birth to naked swarm-cells.
2. The swarm-cells unite to form a wandering plasmodium.
3. The plasmodium forms eventually the spore-producing fruit-bodies.

The fruit-bodies of stage 3 resemble somewhat closely those of some of the true Fungi, but stages 1 and 2 are far more suggestive of certain lowly forms of animal life. The Mycetozoa seem to belong to the border-land between the Animal and Vegetable Kingdoms and are claimed by both Botanists and Zoologists. In Text-Books of Botany they are usually spoken of as Myxomycetes or 'Slime Fungi' instead of Mycetozoa or 'Fungus Animals.'

The Plasmodium

The plasmodium of different Mycetozoa varies greatly in colour being in certain species watery, milk white, yellow, red. etc. It creeps slowly about in dark, moist places in search of food, spreading in the form of a delicate network through the interior of rotting logs, over decaying leaves and through the humus of the soil. (Fig. 18). Some species feed almost entirely on the living gills of leathery fungi and the researches of Dr. Elliott suggest that fungus mycelium enters largely into the food of a number of other species. When about to fruit the plasmodium creeps out from its feeding ground to some more exposed place and proceeds to develop spores.

Fruit Bodies

With the exception of the very common Ceratiomyxa which bears its spores on the outside of branched coral-like 'sporophores' (Fig. 12, d.) the spores of the Mycetozoa are formed inside walled fruit-bodies.* In some genera such as Reticularia the entire plasmodium forms a single cushion-like growth or aethalium which consists of a closely crowded mass of imperfectly formed sporangia. (Fig. 1). The rusty threads which occur among the spores are really the persistent remains of the walls of the individual sporangia and may be spoken of as a 'false capillitium.' Another very conspicuous Mycetozoon which forms large aethalia on decayed wood is *Fuligo septica*. The bright lemon-yellow plasmodium is often seen at Kirstenbosch emerging from old stumps. The outer covering of the aethalium contains lime granules and is very brittle while a true capillitium of delicate threads containing 'lime-knots' forms a loose network in the interior. This species often occurs in England on heaps of spent tan and is popularly known as 'Flowers of Tan'. *Lycogala epidendrum*, also abundant at Kirstenbosch, has very much smaller aethalia about 1 cm. in diameter. They are usually found in groups on the surface of decayed wood and when mature are brownish in colour though the immature aethalia are pink or orange and the plasmodium which produced them was of a deep red. In the aethalium of *Dictydiaethalium plumbeum* (Fig. 4, a.) the tips of the various sporangia which form the fruit body can easily be seen with a magnifying glass, the threads extending downwards from these tips being all that remains of the lateral walls. (Fig. 4, b.). A beautiful growth of this species was collected in the Rain Forest at the Victoria Falls and immature specimens have been found in the Stellenbosch district. In *Tubifera ferruginosa*, one of the Mycetozoa common on old Eucalyptus stumps in the Knysna district, the plasmodium form a closely crowded group of elongated sporangia each with its wall complete. (Fig. 8). The cluster of long-stalked, cylindrical sporangia of Stemonitis resembles a group of tiny brown feathers. (Fig. 9). In this abundant genus the sporangial walls are very fragile and soon disappear leaving behind a true capillitium in the form of a network of threads from the meshes of which the spores are sifted by the wind. In the closely allied *Comatricha typhoides* (Fig. 10) the sporangia are less closely crowded and the silvery-grey walls are somewhat more persistent. A re-

*The parasitic Plasmodiophora which causes the familiar club-root disease of young cabbage plants is closely related to the typical Mycetozoa. The plasmodium lives inside the cell cavities of the host where it finally breaks up into a mass of naked spores.

markably fine growth of this species was found at Kirstenbosch on the lower side of an old log.

The sporangia of some Mycetozoa such as Arcyria (Fig. 2) contain, in addition to the spores, a spongy network of elastic threads which vary in colour in the different species of the genus. The threads in the crowded yellow sporangia of Trichia (Fig. 3) are somewhat similar, but instead of being united into a network they lie freely among the spores. The capillitium in these and related forms shows hygroscopic movements which help in the rupture of the sporangia and in spore dispersal. In the genus Badhamia the rigid capillitium is impregnated throughout with lime, while in the allied genus Physarum (Fig. 6) the lime occurs in definite expansions of the capillitium known as 'lime knots.' The species of Diachaea on the other hand possess a delicate sporangial wall and a capillitium entirely free from lime, but the massive limy stalk is continued through the middle of the sporangium as a columella (Fig. 7). Two of the most interesting sporangia met with among Mycetozoa are those of Dictydium and Cribraria. In neither genus is there a capillitium, but the wall of both is unequally thickened, and as the sporangia mature the thinner parts of the wall break away leaving a number of perforations through which the spores are sifted by the wind as in the familiar fruits of flowering plants with 'pepper-box mechanisms.' The species of Cribraria figured (Fig. 15) is common on old pine stumps. The lower part of the wall remains intact while the upper part becomes perforated in a sieve-like manner. In *Dictydium cancellatum* the old sporangium resembles a loosely woven basket. This species was found in abundance on old cocoa-nut fibre in the Botanical Greenhouse, Stellenbosch. The sporangium figured (Fig. 13, a) was removed with a pair of fine pointed forceps and gently blown upon for some seconds to imitate the action of the wind. In this way most of the spores were sifted out through the perforated wall, though a compact ball of spores may still be seen inside the sporangial cavity.

Where to look for Mycetozoa

Though native forest and wooded ravines prove specially happy hunting grounds for Mycetozoa, many species may be found nearer home. Old logs and stumps should be searched for the white coral-like sporophores of Ceratiomyxa which appear shortly after rain, for the brittle grey sporangia of Badhamia, the feathery tufts of Stemonitis and the yellow, red and ash-coloured clubs of Arcyria as well as for the larger fruit bodies of Reticularia, Fuligo and Tubifera. The bark and broken ends of fallen twigs may yield the yellow net-like fruit bodies of *Hemitrichia serpula* (Fig. 14) the egg-like sporangia of *Didymium difforme* and the yellow-pink or white pin-heads of Physarum. Heaps of garden rubbish and decaying leaves often prove specially rich collecting grounds. In June, 1916, a quantity of old potato haulms which had been left lying in a heap at the side of a kitchen garden was found to be thickly covered with the grey pin-like sporangia of *Physarum pusillum* (Fig. 6). The varnished-looking brown sporangia of *Leocarpus fragilis* (Fig. 5) are often found on old pine needles, as are the orange-coloured heads of *Physarum auriscalpium* and the grey sporangia of *Didymium nigripes*. If the pile of leaves is a large one mature sporangia may be collected in the upper layer and the plasmodia, spreading over the moist leaves in the form of a yellow, white or brown network, may be found down in the heap.

But it is not only on dead vegetation that the sporangia of Mycetozoa are to be found. The plasmodia of many species may creep up the leaves and stems of living plants and form sporangia an inch or more above the humus which served as its feeding ground during its vegetative phase. The widely distributed *Physarum vernum* occurs regularly on turf covering patches several inches in diameter with a grey mould-like growth. In Rhodesia the sporangia of the common *Diachaea leucopoda* have been found thickly covering the lower leaves of young tobacco plants. The beautiful iridescent sporangia of *Lamproderma scintillans* figured (Fig. 11) were collected on the root of an air orchid growing in a Stellenbosch greenhouse.

The majority of Mycetozoa sporangia are of small size — one millimetre or little more in length — and require to be searched for carefully. With a little practice even the smallest may be recognised and sometimes identified specifically with the naked eye. It often happens that the plasmodium as it emerges for fruiting is more conspicuous than the mature sporangia. The places where such sporangia occur should be carefully marked and examined at intervals during the next day or two. Even in native forests this method of securing sporangia has proved successful, though on one occasion a troop of baboons had got there first and had overturned the larger logs and torn the decaying stumps to pieces in their search for grubs and scorpions. It is sometimes possible to bring home a piece of decayed wood from which a plasmodium is emerging and watch the further development at one's leisure. Not long ago a weathered pine cone covered with small heaps of watery white plasmodium was

brought into the laboratory and put under a bell jar, when the various stages in the development of the sporophores of Ceratiomyxa figured (Fig. 12) were easily studied.

How to collect Mycetozoa

It is wise to provide oneself with a basket, a number of small boxes (match boxes or cigarette boxes answer admirably), a quantity of tissue paper, and a strong knife. The sporangia are exceedingly fragile and must be handled with great care. Each specimen as collected should be packed in crumpled paper so as to prevent shaking and placed in a box. With a little care even the most delicate sporangia may be packed so as to avoid injury. Some collectors prefer to line the boxes with cork and pin the fragments of wood or leaf bearing the sporangia firmly to the cork.

How to preserve Mycetozoa

The first thing necessary is to allow the specimens to become perfectly dry as they are very liable to get mouldy if shut up closely when they are at all damp. The other essential is to store them in such a way that injury from shaking or from attacks of insects is prevented. A convenient method is to put some naphthalene at the bottom of a small box, cover lightly with wadding or tissue paper and then fit in securely a false bottom of thin paste board to the upper surface of which the specimen is gummed. The false bottom may be perforated so as to allow of the free passage of the naphthalene fumes. Specimens so preserved can be readily examined with a magnifying glass or under a dissecting microscope and should last indefinitely. For microscopic examination a detached sporangium should be placed on a glass slide, moistened with a little alcohol and then examined in a drop of water. The spores can be got rid of by gently blowing on the dry sporangium or by tapping the moist sporangium with dissecting needles. Specimens for examination under a compound microscope can be mounted permanently in glycerine jelly or Canada balsam.

Conclusion

It is impossible in an uncoloured plate to give any idea of the marvellous beauty to be met with among these fragile organisms. The collection and study of Mycetozoa is a very interesting hobby and like most hobbies, grows upon one. Thus far about ninety species have been collected in South Africa but many others await discovery. The writer of this article will be pleased to receive specimens from any collector who may be good enough to forward them. For generic identification an outline key of genera already found in South Africa is appended.

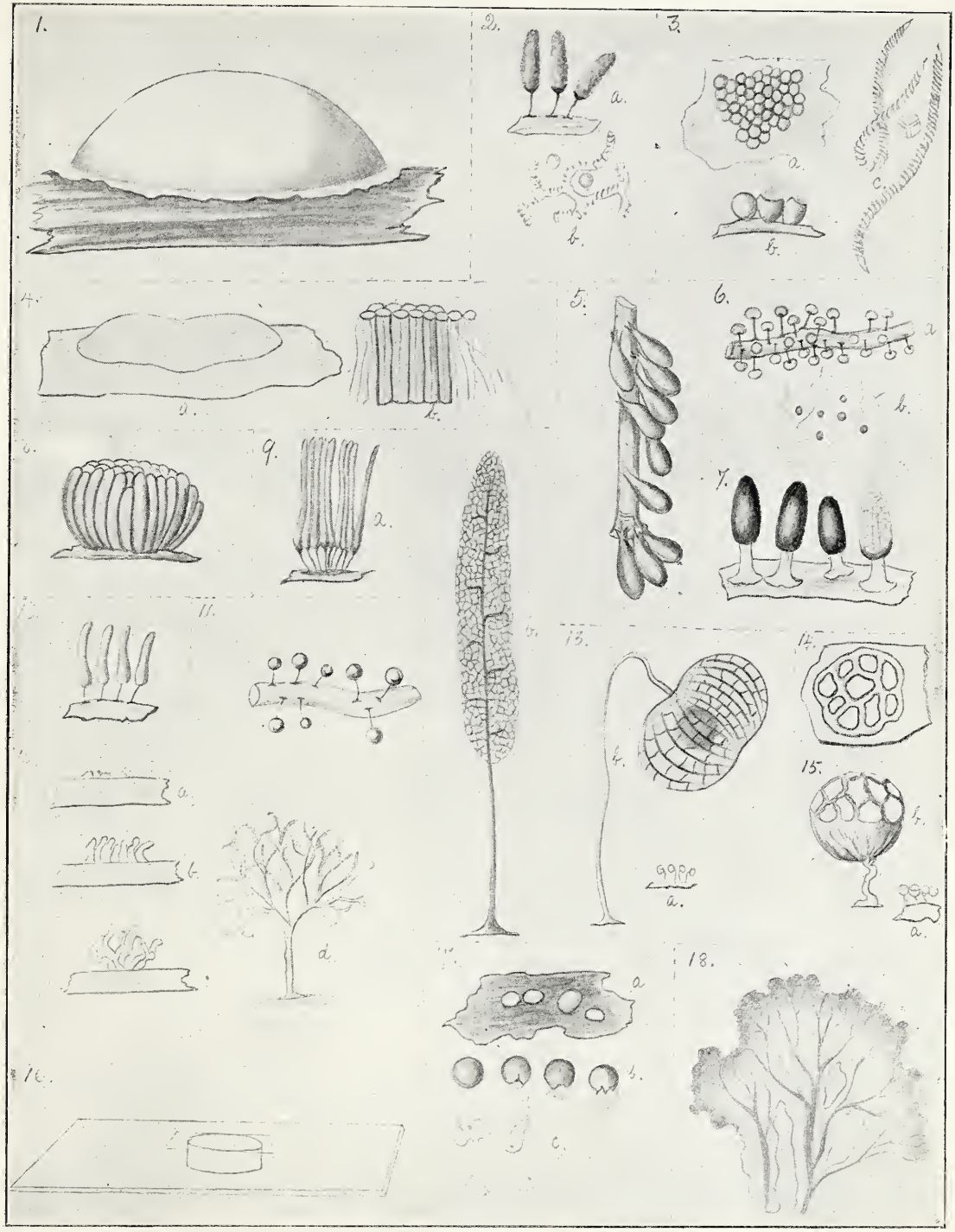
KEY TO THE GENERA OF MYCETOZOA KNOWN TO OCCUR IN THE UNION OF SOUTH AFRICA.

Sub-class I. EXOSPOREAE. Spores developed outside a sporophore.
- Order I. CERATIOMYXACEAE. Sporophores membranous, branched; spores white, borne singly on slender stalks.
- Genus 1. *Ceratiomyxa*.

Sub-class II. ENDOSPOREAE. Spores developed inside a fruit body.
- Cohort I. Spores violet-brown or purplish-grey when magnified and seen with transmitted light.
- Sub-cohort I. Calcarineae. Sporangia provided with lime.
- Order I. DIDYMIACEAE. Lime in the form of crystals deposited outside the wall of the sporangium.
- Genus 2. *Didymium*. Sporangia not united into an aethalium.
- Genus 3. *Mucilago*. Sporangia united to form an aethalium.
- Order II. PHYSARACEAE. Lime not deposited outside the wall of the sporangium.
- A. Capillitium a coarse network charged with lime throughout.
- Genus 4. *Badhamia*.
- B. Capillitium a network of slender threads with lime-knots.
- a. Sporangia united to form an aethalium.
- Genus 5. *Fuligo*.
- b. Sporangia not combined to form an aethalium.
- Genus 6. *Physarum*. Sporangia sub-globose, lenticular or in the form of plasmodiocarps; capillitium without free-hooked branches.
- Genus 7. *Trichamphora*. Sporangia saucer-shaped on dark reddish stalks.
- Genus 8. *Physarella*. Sporangia stalked, shortly cylindrical, perforated from above by a deep umbilicus.
- Genus 9. *Cienkowskia*. Sporangia in form of spreading plasmodiocarps; capillitium with free-hooked branches.

EXPLANATION OF PLATE: SOUTH AFRICAN MYCETOZOA.

1. Aethalium of RETICULARIA LYCOPERDON, natural size.
2. ARCYRIA DENUDATA. *a*, sporangia enlarged; *b*, spores and part of capillitium highly magnified.
3. TRICHIA AFFINIS. *a*, group of sporangia twice natural size; *b*, three sporangia more enlarged; *c*, spore and elaters highly magnified.
4. DICTYDIAETHALIUM PLUMBEUM. *a*, aethalium natural size; *b*, part of aethalium enlarged.
5. LEOCARPUS FRAGILIS. Five times natural size.
6. PHYSARUM PUSILLUM. *a*, group of sporangia enlarged; *b*, spores and capillitium threads highly magnified.
7. DIACHAEA LEUCOPODA, enlarged.
8. TUBIFERA FERRUGINOSA, enlarged.
9. STEMONITIS SPLENDENS. *a*, small group of sporangia enlarged; *b*, single sporangium highly magnified.
10. COMATRICHA TYPHOIDES, enlarged.
11. LAMPRODERMA SCINTILLANS, enlarged.
12. CERATIOMYXA FRUTICULOSA. *a-c*, stages in the development of the fructification from the plasmodium; *d*, mature sporophore, much enlarged.
13. DICTYDIUM CANCELLATUM. *a*, group of sporangia, twice natural size; *b*, sporangium, highly magnified.
14. Plasmodiocarp of HEMITRICHIA SERPULA, enlarged.
15. CRIBRARIA ARGILLACEA. *a*, group of sporangia, twice natural size; *b*, sporangium, highly magnified.
16. Slide with hanging drop culture.
17. DIDYMIUM DIFFORME. *a*, sporangia, four times natural size; *b*, germinating spores; *c*, swarm cells, highly magnified.
18. Part of plasmodium of BADHAMIA UTRICULARIS, enlarged.



Del. A. V. Duthie.

South African Mycetozoa.

Genus 10. *Craterium*. Sporangia goblet-shaped, usually with a distinct lid.
Genus 11. *Leocarpus*. Sporangia ovoid, shining, clustered, with membranous stalks.
c. Capillitium without lime-knots.
Genus 12. *Diderma*. Sporangium-wall opaque, smooth, containing granular deposits of lime.
Genus 13. *Diachaea*. Sporangium-wall without lime. Walls of stalk and columella charged with lime.
Sub-cohort II. **Amaurochaetineae**. Sporangia without lime.
Order I. STEMONITACEAE. Sporangia distinct, provided with stalk and columella.
Genus 14. *Stemonitis*. Sporangium-wall evanescent; capillitium arising from all parts of the elongated columella, ultimate branches united to form a superficial net.
Genus 15. *Comatricha*. As in Stemonitis but capillitium not forming a superficial net.
Genus 16. *Lamproderma*. Sporangium-wall shining with iridescent colours, somewhat persistent.
Cohort II. Spores variously coloured but not violet-brown or purplish-grey.
Sub-cohort I. **Anemineae**. Capillitium absent.
Order I. HETERODERMACEAE. Sporangia not densely crowded. Sporangium-wall membranous forming a net in the upper part.
Genus 17. *Dictydium*. Sporangium-wall with thickenings in the form of nearly parallel ribs.
Genus 18. *Cribraria*. Thickenings of sporangium-wall not parallel.
Order II. TUBULINACEAE. Sporangia clustered, cylindrical or ellipsoid.
Genus 19. *Tubifera*. Sporangia cylindrical, crowded on a common hypothallus.
Order III. RETICULARIACEAE. Sporangia closely compacted and usually forming an aethalium.
Genus 20. *Dictydiaethalium*. Sporangium-walls incomplete, continued down to the base in 4 to 6 straight threads.
Genus 21. *Reticularia*. Aethalium composed of many elongated interwoven sporangia with incomplete walls.
Order IV. LYCOGALACEAE. Sporangia forming an aethalium; pseudo-capillitium of branched, colourless tubes.
Genus 22. *Lycogala*. Aethalium sub-globose or conical.
Sub-cohort II. **Calonemineae**. Capillitium present as a system of uniform or sculptured threads.
Order I. TRICHIACEAE. Capillitium consisting of tubular threads which are either free and unbranched or form a branching network; thickenings in the form of spirals or rings.
Genus 23. *Trichia*. Capillitium consisting of free elaters with spiral thickenings.
Genus 24. *Hemitrichia*. Capillitium consisting of a network with spiral thickenings.
Order II. ARCYRIACEAE. Capillitium consisting of a network of tubular threads thickened with cogs, half-rings, spines or warts.
Genus 25. *Arcyria*. Capillitium elastic, sporangium-wall evanescent above, persistent as a cup below.
Genus 26. *Perichaena*. Capillitium not elastic, sporangium-wall usually double.

Botanical Department,
University of Stellenbosch.
Dec. 1923.

Nature Rambles at Kirstenbosch.

By LETITIA STARKE.

THE "bright and intricate device of days and seasons" does indeed suffice to make our Rambles at Kirstenbosch "a cheerful and a changeful page"; but in order to prevent vague and aimless observation, four walks have been arranged; not only to harmonise with these various seasons, but to cover a definite course of Nature Study in the field. These Rambles, however, often undergo considerable modification to suit the children's standard of attainment or the gradual merging of one season into another.

Summer

The Summer Ramble is based upon the classification of plants according to the amount of water needed. This is begun by a visit to the Pond, perhaps most popular amongst some little people whose delight at passing into Standard IV. was said to be enhanced by the fact that "now they could go to Kirstenbosch!" The children are quick to see the force of contrivances employed by the water-lilies, the water-hyacinth, water-weeds and other plants for maintaining an adequate supply of air; and quick also to admire the beautiful blue of our native water-lily, and to realise the need for protecting so lovely a flower.

The fish, lying in wait under the water-weed for their daily ration of bread-crumbs, the frogs and tadpoles, even the crusty crabs come out for inspection. A veritable prince of Dragon-flies, fully five inches long, has been recorded here; and there are not wanting dainty Damsel-flies, long-legged "skaters" and glittering whirligig-beetles to claim our attention. If only a Water-Baby would rise from the Lilies and share with us the secrets of housekeeping beneath the quiet waters of the Pond!

The adaptations against drought of Karroo Xerophytes in the Nursery are a constant source of astonishment and

interest; while collections of typical leaves are made along the Contour Path in order to contrast the vegetation of gorge and hillside. The forest-formation is discussed, and, on finding that they know about a dozen introduced, to one indigenous tree, the boys are all eagerness to become acquainted with at least ten of their native trees.

The Grasshopper tribe, the Orthoptera, loudly proclaim that at present they are supreme in the insect-world. From the tiniest green youngster to the adult brown locust they may be seen in every stage of development, while often an empty moult is found fluttering along "some strip of herbage," for all the world like gloves and stockings of membrane. One December we had the good fortune to witness a young female Blaasop performing this delicate operation; nor could we feel guilty of any impropriety, as she stepped out fully arrayed in as resplendent a frock of green as she had just discarded. Stick-insects, with mincing gait, scuttling cockroaches and the relentless Hottentots' God, all members of the same order, are often seen en route.

The Cicada, beating his shrill, intermittent cymbals, is heard near the woods, where his light-brown chrysalis-case may be found clinging to the trunk of some tree. A sad fate was that of a Cicada we saw being neatly engulfed on the wing by the black and white Butcher-Bird.

The Mecca of our Summer Ramble is Ilex Cliff, where clusters of Disa uniflora adorn the steep sides of a precipice, almost sheer for fifty feet. At the base we found, this summer, the complete skeleton of a Dassie, who had evidently leapt — perhaps for liberty — to meet below an even more terrible death.

Last year some men were found plucking these Disas, and the children's indignation or the knowledge of their presence seems to have had some effect, for they have been left unspoiled this season.

Autumn

Autumn gives ample opportunities for observing habit of growth in plants. The Dell is full of illuminating examples of plants needing support and the walk up Skeleton Gorge supplies local illustrations of climbers, for example the Wild Vine, twiners, such as Dolichos and the Monkey-Rope, scramblers like the Kruis-bessie, and the epiphytic fern. Polypodium, a clasper.

The splendid pageant of the Amaryllidaceæ, heralded by the Scarlet Haemanthus and its attendant butterfly Meneris, passes with the regal Brunsvigia, Buphane, and the graceful Nerines in its procession, not forgetting the Belladonnas at Amaryllis Meet, set in a glade as fair as even that of the Arcadian shepherdess to whom they owe their name.

Nor can we pass the Blister Bush, the Wild Peach and the Arum without marvelling a little at the calm content of caterpillars, while their indifferent parents are bidding fluttering farewells to the brightest and the sweetest of the flowers, nor without wondering at the strangeness of instinct which leads the butterfly to confine her egg-laying to certain related species of plants.

And in the spider-world what cunning and industry on all sides! The Garden Spider has deftly hidden her cocoons, carefully camouflaged, on a neighbouring bush. Cyrtophora sits like a grim Minotaur in the centre of her labyrinthine web, guarding her chaplet of silken cocoons. Palystes patiently awaits the end beneath her children's bower, while other spiders attach these precious burdens to their spinnerets.

Winter

During the Winter months methods of obtaining food are studied, for fungi are plentiful in the sodden forests, and the glistening Sundews lift their purple heads along the Contour Path; whilst if it is yours to possess what E. V. Lucas calls, "the luck of the woods", haply you may find the root-parasite, Hyobanche sanguinea, on Silver Tree Ridge.

The Proteas, of truly "Attic shape" are visited at this time by brilliant Sunbirds, while the Long-tailed Sugar-bird puts us to shame by preferring above all others the quiet beauty of the Protea which we call "incompta"! Varied in form as their proto-type, the sea-god Proteus, they are an excellent family for the study of genera; as Oxalis, flowering from March onwards, is for the study of species. These cheerful little flowers are first favourites with the children, although the great Winter sight is the Aloe Knoll by Window Gorge, where Aloes rear their scarlet spikes against grey rocks and trees, encrusted with lichen, in a place seemingly as old as time itself.

The insects, wrapped in their metamorphic sleep, have bequeathed the duty of pollination to the birds and the winds; and for other signs of animal life we must seek in decayed wood and beneath logs and stones — finding indeed, "tongues in trees" and "sermons in stones"! Several fine specimens of Peripatus capensis have been found in these haunts. This handsome little creature, sometimes nearly three inches in length, and clad in velvet black or brown, grows rarer with the advancing Winter, and in Spring only a few young ones, about half-an-inch at most, are found in the damper places. They would appear to be very slow growers, as, according to Professor Sedgwick, who came to the Cape expressly to study this unique link between the worms and the insects, they are said to breed in April.

Centipedes and scorpions, though not less interesting, must be handled respectfully. With the aid of specimen tubes, however, the children can study, in perfect safety, the details of their external structure.

Earthworms and their egg-pellets, slugs, ants, busily carrying their larvæ, the quaint mole-crickets, earwigs, brown grubs, which, when reared, turned out to be hump-backed flies, Devil's-coach-horse beetles, cocoons of the hairy caterpillar and several species of spiders are among the many treasures of Natural History to be found beneath the stones in Winter.

Spring

The Spring annuals who dare not wait until the Summer drought, small Nemesias, the Golden Sebaea, Cryptostemma and the ephemeral weeds of cultivation all combine to make length of life peculiarly fitting as the basis of our plant-work for the Spring Ramble. The Podalyria, foremost in beauty amongst the shrubs, the Keurboom, most graceful of trees, and the "many-splendoured" Irids, now appearing from their underground resting-stocks, are only a few of all the examples at hand to illustrate our subject.

The Piet-myn-vrou, with his insistent call, the Swallows, the Swifts and other migrants return to us. Those busy little gossips, the White-eyes, never cease their inquisitive chirruping. The Bacbakiri is engrossed in family affairs, and the tiny Tinktinkies are lining their charming little nests with woolly material from the hill-side shrubs.

The Beetles outnumber all other insects. From the magnificent Protea-beetle, resplendent in iridescent green, to the strange Click-beetle, found lying mummy-like in old logs and jumping unexpectedly with a "click" into the air, they come from every conceivable quarter. Clambering monkey-beetles, musk-scented long-horn beetles, slow-footed ground-beetles, hasty tiger-beetles, are all on business or on pleasure bent.

We were fortunate enough on some of our explorations to find the larva, chrysalis and imago of one of the Scarabs in an old log near the Chestnut Avenue, and later to see the beetle at work pollinating the cream, sweet-scented flowers of the Wild Almond. The gardeners, indeed, have brought serious charges against our protégé, but until such time as these can be investigated we shall reserve our judgment.

These Rambles are designed to stimulate the children's interest and to direct and unify their observations, for as Fabre so wisely says, "An omnium-gatherum of facts is not knowledge, but at most a cold catalogue which we must thaw and quicken at the fire of the mind; we must bring to it thought and the light of reason; we must interpret."

Kirstenbosch,

February, 1924.

The Bees and Wasps of Kirstenbosch.

By S. H. Skaife.

THE Hymenoptera form a very large and important order of insects that includes ants, bees and wasps. All the winged members of this order have two pairs of membranous wings, a characteristic to which the scientific name, Hymenoptera, refers, as it means "insects with membranous wings." The mouthparts are similar throughout the group, consisting of a pair of stout mandibles and a tongue adapted for licking up nectar. The adults usually have three simple eyes, or ocelli, in addition to two large compound eyes, but in some of the wasps the simple eyes are absent, and certain species of worker ants lack the compound eyes as well.

The hind wings are connected with the front wings, when the insect is in flight, by a row of minute hooks situated along the front margin of the hind wings which catch in a fold along the hind margin of the front wings. When the hymenopteron comes to rest the wings are easily disconnected and folded over one another along the back. The thorax of the adult consists of four segments, not three as in other insects, for the first abdominal segment is fused with the last segment of the thorax: what appears to be the first abdominal segment is really the second.

The ovipositor of the female takes the form of a sting in the higher members of this order. As the males are naturally without ovipositors, they cannot sting. The sting consists of two slender lancets, barbed at the tip, which slide up and down a tubular sheath. When the female stings, the sheath is thrust through the skin, and the lancets probe still deeper and carry with them the poison from the poison sac, which is lodged at the tip of the abdomen and connected with the sting by a slender tube. Among the ants, bees and wasps the antennæ of the males are thirteen-jointed, whereas those of the female have only twelve joints.

A brief outline of the classifaction of the Hymenoptera is given in the last section of this article. Only four of the ten super-families into which the order is divided are dealt with here, namely: the Chrysidoidea, Vespoidea, Sphecoidea, and the Apoidea. The saw-flies, gall-flies, innumerable parasitic forms, and the ants are not touched upon at all owing to the limitations of space.

Chrysidoidea.

CHRYSIDAE.

This group is the only family of the Chrysidoidea, and includes the insects popularly known as ruby wasps (Figure 13). They are fairly common insects and may often be found haunting the flowers at Kirstenbosch, or hunting over the banks and walls for the nests of other bees and wasps. They are easily recognised by their bright, shining metallic colours, usually blue or green. They are mostly about half an inch long and have short smoky wings. The integument is hard and thick, and the insects can roll themselves up into a ball with only the hard skin of the back exposed. This is possibly their way of protecting themselves from the stings of indignant bees and wasps into whose nests they penetrate.

The great majority of the ruby wasps are parasitic on other bees and wasps, but a few of them are parasitic on caterpillars. Very little is known about the habits of the South African species.

Vespoidea.

The super-family Vespoidea is a large group that includes ten families. The members of this group may be recognised by the structure of the first segment of the thorax. The pronotum (that is to say, the dorsal portion of the first thoracic segment) extends back on each side as far as the base of the front wings (Figures 1 and 4). In the next group, the Sphecoidea, the pronotum is much smaller and does not reach the base of the wings; it consists of a narrow transverse band just behind the head.

SCOLIIDÆ.

The Scoliidæ is a family of large hairy wasps included in the Vespoidea. They are all solitary and prey upon the larvæ of certain beetles. At least one species occurs at Kirstenbosch, and there may be others unknown to the present writer. In October a black, burly wasp, about three quarters of an inch long, with five bands of white hairs on the abdomen (Figure 10) may be found visiting the flowers of the mesembryanthemums. The male is slightly smaller than the female, but similarly marked: this is not usually the case among the Scoliidæ, for the males are generally much smaller than the females and differently coloured.

After spending a few days philandering amid the flowers, the female sets out to find her prey, seeking in loose earth and amid heaps of decaying leaves. Her stout legs, armed with stiff bristles, enable her to burrow freely and rapidly in such places. The fat white grub that forms her prey is the larva of a Cetoniid beetle. This larva, about an inch long, feeds on rotting vegetation and may be easily recognised from its peculiar habit of creeping along on its back. When the wasp finds a larva she at once attacks it and stings it on the underside of the thorax, where the chief nerve centres that control the movements are situated. This does not kill the grub but only paralyses it and renders it incapable of movement. Then, without more ado, the wasp lays an egg on the larva's body and leaves it lying where she found it, amid the decaying leaves or in the loose soil. She seeks out larva after larva in this way, paralysing each in turn and depositing an egg on it. When her ovaries are exhausted she dies. In all probability, none of the hunting wasps is prolific and fifteen to twenty eggs is about the number laid by each female.

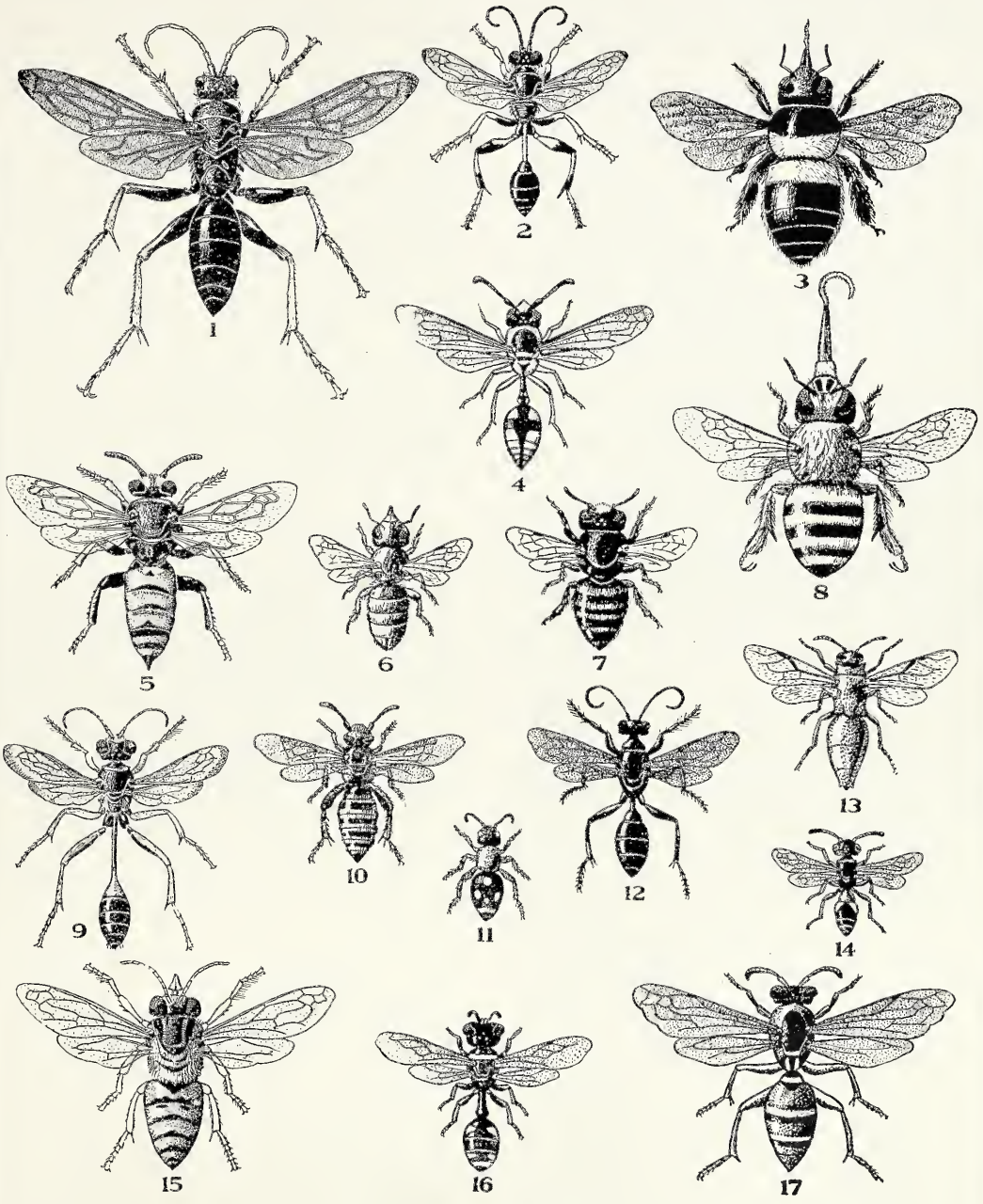
The egg attached to the beetle grub, hatches out into a blind, white, legless maggot which feeds on the paralysed larva provided by the mother. When the wasp larva is fully grown it spins an oval brown cocoon on the shrivelled skin of the Cetoniid grub and pupates.

MUTILLIDAE.

The next family of the Vespoidea is comprised of peculiar insects popularly known as "velvet ants". The females are wingless and antlike in form (Figure 11) and their bodies are generally covered with dense hairs which give them a velvety appearance. These insects can be distinguished

BEES AND WASPS OF KIRSTENBOSCH.

1. Salius (Hemipepsis) capensis, Fabr. (*natural size*).
2. Sceliphron quartinae, Grib. (*natural size*).
3. Xylocopa caffra, Lin. (*natural size*).
4. Eumenes caffra, Lin. (*natural size*).
5. Palarus latifrons, Fabr. (X 2).
6. Halictus jucundus, Smith. (X 2).
7. Megachile venusta, Smith. (X 2).
8. Anthophora niveata, Fries. (X 2).
9. Sphex (Ammophila) egregia, Moes. (*natural size*).
10. Elis quinquefasciata, Fabr. (*natural size*).
11. Mutilla andromeda, Peringuey. (*natural size*).
12. Sphex bohemani, Dahl. (*natural size*).
13. Hexachrysis lyncea, Fabr. (X 2).
14. Philanthus histrio, Fabr. (*natural size*).
15. Bembex olivata, Dahl. (X 2).
16. Dasyproctus simillimus, Smith. (X 2).
17. Polistes rubidus, St. Farg. (X 2).



S. H. Skaife, del.

Bees and Wasps.

from the true ants, however, by their larger size, by the fact that they are always solitary, and they have not the peculiar waist found in the ant. Several species occur at Kirstenbosch varying in length from a quarter to three quarters of an inch. All are similar in general colouration; the thorax is dark red and very hard, and the abdomen is black, variously marked with patches and bands of silvery hairs. The females may be found running restlessly over the ground in the hot sunshine. They are armed with long, formidable stings, therefore it is inadvisable to handle them. The males of most species are winged and may be found visiting the flowers. It is said that the peculiar squeaking sound produced by the females attracts the males, and that, if a female is held down by means of a twig, she will produce her shrill call and thus attract any males of the same species that happen to be in the vicinity.

Little is known about the habits and life histories of the Mutillidæ. They are said to be parasitic. The females seek out the nests of solitary bees and wasps and deposit their eggs in them. Whether the mutillid larva feeds on the provisions or on the larvæ of their hosts does not seem to be certainly known.

POMPILIDAE.

The Pompilidæ include some of the largest and most striking of all the Hymenoptera. Several species are common in the Kirstenbosch grounds, the largest being a handsome insect, shining black in colour, with smoky brown wings and measuring about an inch and a half in length (Figure 1). The other species are smaller, some being quite small, but all are similar in the habits.

The males are idlers, as is the case throughout the Hymenoptera, and may be found haunting the flowers from October onwards. The females on the other hand, after a brief spell of idleness, spend the rest of their lives in arduous toil, preparing for the next generation. They are all fierce huntresses and attack and paralyse spiders with which they provision their nests.

The species mentioned above (Figure 1) hunts the large ground spider that is often misnamed "tarantula." This formidable creature, nearly three inches across the outspread legs, is tawny-brown in colour and the legs and the underside of the abdomen are banded with black. The Pompilid female hunts out these spiders as they lurk amid the undergrowth. As soon as she finds one, she unhesitatingly attacks it. The fight is short, and, whilst it lasts, appears to be a wild jumble of whirling legs and wings. According to Fabre, the great French entomologist, the Pompilid first stings the spider at the base of the deadly fangs that are lodged on the front of its head. This renders the spider harmless as her weapons of offence and defence are paralysed and useless. The wasp then knocks the spider over on to its back, stands astride its body, and stings it in the main nerve centre that controls the movements of the legs. This ganglion is lodged in the thorax, near the base of the last pair of legs.

The Pompilid now seizes its paralysed victim by one of its legs or pedipalps and drags it away to a burrow she has already prepared in the soil. The prey is drawn down into the burrow and lodged on its back in a cell hollowed out a few inches below the surface of the soil. The wasp lays her long, oval, white egg on the body of the spider, placing it diagonally across the thorax, between the bases of the legs. She then leaves the burrow, carefully closes the entrance by sweeping loose soil into it, and flies away to repeat the whole process elsewhere. She never sees the offspring for which she labours so indefatigably; in fact, after the entrance has been closed, she shows no signs of any further interest in the burrow.

The egg deposited on the spider hatches in a few days into the usual blind, white maggot that characterizes the great majority of the Hymenoptera. It feeds on the fresh tissues of the paralysed prey, and by the time the spider has been devoured, the larva is fully grown. It spins a silken cocoon and, after a more or less prolonged resting stage, changes into a pupa from which the adult eventually emerges.

EUMENIDÆ.

The Eumenidæ form a large family of interesting wasps popularly known as "mud wasps", because of the habit of constructing their nests of mud. It must be remembered, however, that certain members of other families also make mud nests. Most Eumenids are rather small, of slender build, and yellow, black, or reddish-brown in colour. The wings, when at rest, are folded longitudinally, and they are usually tinted. All these wasps, as far as known, provision their nests with paralysed caterpillars.

Eumenes caffra (Figure 4) is fairly common at Kirstenbosch. This is a handsome insect, about an inch long, and yellow and black in colour. It builds neat mud cells in sheltered spots — under stones, in holes, in outbuildings, etc. It collects mud for this purpose from the banks of a pool or stream, and as such dried mud would easily be softened and washed down by rain, it is forced to build its nest in sheltered spots. The cell is dome-shaped, with a small circular entrance surrounded by a neat curved lip. As soon as the cell is complete, the wasp deposits her egg in it, before any provisions are brought in. The egg

is not placed on the floor of the cell, but is suspended from the roof by a short slender thread.

The wasp now sets out to hunt caterpillars. She attacks the larvæ of one family of moths, usually the Geometridæ, known as "looper caterpillars" because of their peculiar mode of walking. She generally restricts herself to one particular species of caterpillar, but will apparently attack other loopers if they happen to come her way. Three to six paralysed caterpillars (the number depends on the size of the victims) are placed in a cell and the entrance is then plugged with mud. Another cell is commenced immediately after the completion of the first one, and so it goes on until a dozen or so have been constructed; after this the wasp dies.

The young larva does not quit the egg-shell when it hatches but remains suspended head downwards from the roof. From this position it stretches down and commences to feed. The caterpillars are only partially paralysed and are capable of vigorous lashing movements when irritated, therefore it is advantageous for the tender young wasp larva to be able to retreat towards the roof in order to escape the kicks of its victims; when the larva is larger and stronger it drops down and feeds in the usual manner.

A large black Eumenes with habits similar to those described above, is also found at Kirstenbosch. There are several smaller species of Eumenids which nest in holes in walls, in hollow stems, under stones, etc. They all use mud either for building cells or for partitioning off their nests.

Vespidæ.

The Vespidæ, unlike all the other wasps mentioned above, are social in their habits. These insects have wings which are folded longitudinally when at rest, as in the Eumenidæ, but they differ from the latter in having two spurs on each middle tibia instead of only one and in having simple claws; — in the Eumenidæ each claw is armed with a minute tooth.

Polistes rubidus (Figure 17) is quite common at Kirstenbosch. This insect, red, yellow, and black in colour is over half an inch in length and may frequently be seen at flowers during the summer months. The fertilized females hibernate during the winter and emerge in spring, when each one sets about founding a colony. She collects wood fibres from rotting posts and other sources and chews them up, mixes them with saliva, and forms neat, grey, hexagonal cells from the pulp. The nest is attached by a short stalk to a sheltered spot, such as in the middle of a dense bush or under the eaves of a house. The cells are placed side by side in a horizontal layer, with their mouths downwards, and they closely resemble the cells constructed by the honey-bee. The foundress, or queen, deposits eggs in the cells and feeds her grubs mainly on mashed-up insects. Probably nectar and other sweet substances also form a part of the diet. Females or workers are developed and they help the queen their mother by enlarging the nest and bringing food for the larvæ. Towards the end of the summer males are produced as well as females. The former mate with the latter and die, whilst the fertilized females seek out hiding places in which they can sleep through the winter. In the following spring each one sets about establishing a colony as described above.

Much still remains to be learned about the domestic economy of Polistes, but they are difficult objects of study as they will sting fiercely if their nests are disturbed, although they are harmless and pacific enough if left alone. Polistes nests taken by the writer at Kirstenbosch have all been severely parasitized by a fly that closely resembles the common house-fly. It is extraordinary that these fierce wasps which prey largely upon flies, should allow this particular fly to deposit its eggs on their larvæ. The fly maggots that hatch from these eggs destroy the wasp larvæ and pupate inside the cells of the nest. The fly, in its turn, is heavily parasitized by a tiny wasp parasite.

Sphecoidea.

The super-family Sphecoidea is a very large group including fourteen families of wasps, generally termed "digger wasps." As mentioned previously, these wasps are distinguished by the small pronotum which does not extend back as far as the wings. The families are distinguished one from the other by the venation of the wings, the shape of the labrum, of the eyes, and of the petiole, and by certain minor characters of the thorax. It is impossible to deal with all the families in the space available, so only four of those represented at Kirstenbosch are dealt with here.

Crabronidæ.

These little insects are slender, mostly black and white or yellow in colour, and characterised by large square heads.

Dasyproctus simillimus (Figure 16) is quite common and may be found in spring boring into the flower stems of gladioli and watsonias. The female bores a neat, round hole in the side of the stem and then hollows out a tunnel in the soft pith, both above and below the entrance hole. She then captures and stings a number of small flies and stores them at the upper end of her burrow. The flies are so small that most of them seem to be killed outright by the sting and it takes twelve or more to provision one cell. An egg is laid on one of the flies and the cell is closed by

a partition of fibres bitten off from the inside of the stem. Another cell is stocked and closed below the first, and the wasp then generally goes to the lower end of her burrow and commences building up cells from below. In this way some six to a dozen cells are formed inside the flower stalk, most of them being situated below the entrance hole, but two or three (the oldest) are above it, as a rule.

The larvæ grow rapidly and reach full size in about a week. Each one then spins a silken cocoon inside its cell and lines it with a thin paste of liquid excreta. The sanitary problem that has to be faced by the larvæ of most bees and wasps is a difficult one. The larva is confined in a small cell surrounded by its food. If the latter were fouled with excrement it would soon become uneatable. The difficulty is overcome in a remarkable and characteristic manner. Throughout its life, the stomach of the larva has no connection with its intestine, it is "blind", therefore the excrement accumulates in it as a dark liquid mass. After the larva has spun its cocoon, the stomach opens into the intestine for the first time, and the excrement is expelled all at once and utilized by the insect as a thin paste or varnish for the lining of its cocoon. There is more than is required for the purpose and the excess forms a hard plug at the posterior end of the cocoon. The brown cocoon, of a texture resembling that of goldbeater's skin, with a dark plug at one end, is characteristic of the higher wasps.

The Crabronid larvæ go through their metamorphoses quickly and the adults of the second generation emerge from the stems some time in November. It is not known how many generations there are during the summer.

PHILANTHIDÆ.

The Philanthidæ include the well-known bee pirates, predaceous wasps that are among the worst enemies the beekeeper has to deal with in this country. Some members of this family paralyse beetles and stock their burrows with them, but others attack bees. Two species, the yellow bee pirate, and the banded bee pirate (Figure 5) capture hive bees and work havoc during the summer months among the inhabitants of the hive.

The yellow pirate frequents flowers and swoops down upon its prey as the bee comes in search of nectar and pollen. The honey bee seems quite incapable of protecting itself and falls an easy victim to the fierce huntress. The pirate flings herself at the flying bee with astonishing speed and accuracy, winds her body round the bee's neck and stings it on the underside of the neck. Before carrying the body off to her burrow she usually lays it on the ground, underside uppermost, stretches her own body along it and presses and kneads with her abdomen until the nectar stored in the bee's crop is forced out at the mouth. The pirate then laps up the disgorged nectar and flies away with the bee to her burrow, where she lays an egg on the thorax, between the legs.

The banded bee pirate, on the other hand, haunts the hive, and two or three of these wasps, although somewhat smaller than the bees themselves, will so overawe a colony as to keep the bees prisoners in the hive, too terrified to venture out.

The wasp waits on the alighting board or on the side of the hive until a bee ventures out and then swoops down upon it. The male pirate is smaller than his partner and is black in colour, not banded with yellow. He may be found flying around the hives close to the ground.

SPHECIDÆ.

This family includes a great number of species, characterised by a slender petiole of variable length and two spurs on the middle tibia. They nearly all dig burrows in the ground and stock their cells with paralysed grasshoppers, crickets, caterpillars or spiders, the prey varying with the different species, but each species restricting itself to the one type of prey only. The family is well represented at Kirstenbosch.

The genus Sphex (Figure 12) includes several species which are mostly black in colour, with a distinct neck and a short narrow petiole. These insects attack various kinds of grasshoppers and crickets. The prey is apparently stung in three places on the underside of the thorax, each one of the three thoracic ganglia being paralysed in turn.

Ammophila includes several species of slender-bodied wasps, easily recognised by their distinctive black and red coloration. These restless creatures may be seen visiting the flowers, or digging feverishly in the ground, or hunting for the caterpillars that form their prey. The caterpillar is stung some eight or nine times, on the underside of each segment from the first thoracic segment backwards. The paralysed victim is then borne away to the burrow, dragged below and left with an egg adhering to it. The Ammophila is very particular about the closing of its burrow and sweeps the soil into the hole and scratches around until all traces of it are obliterated.

Sceliphron quartinae (Figure 2) is a Sphegid wasp that is fairly common at Kirstenbosch. It builds mud nests in out-buildings, consisting of ten to twenty cells, each of which is stocked with a number of small spiders. The spiders seem to be killed outright by the wasp, not paralysed as in the case of the larger prey of the Pompilidæ. The egg is laid on the first spider placed in the cell, the other spiders being stuffed in on top of the first.

BEMBECIDÆ.

The Bembecidae are silvery-grey and black wasps that love the hottest sunshine and light, sandy soils. *Bembex olivata* (Figure 15) occurs at Kirstenbosch but it can hardly be said to be common there. It preys upon flies, which it captures on the wing like a miniature hawk, stinging them to death and carrying them off to its burrow. According to Fabre, Bembex does not stock cells with the flies, but prepares a number of burrows, lays an egg in each, and carries daily supplies of food to each of its young, very much in the same way as a bird. This peculiar habit is probably due to the fact that the flies are killed outright and dry up very rapidly in the hot summer weather. In consequence the Bembex larva has to receive fresh supplies at frequent intervals, supplies that can be devoured before they have time to become too dry to be palatable. All the solitary wasps are restless creatures, but Bembex is undoubtedly the most feverish of them all When digging in the sandy soil it keeps up a continuous plaintive hum and sends showers of sand shooting out from underneath its body by vigorous kicks of its bristly legs. Owing to the crumbling nature of the soil in which it makes its nest, the entrance is frequently obliterated whilst the Bembex is absent. But this does not incommode it in the least. On its return, it flies without hesitation to the exact spot and re-opens the entrance, although the human observer can see no outward signs that could guide the wasp. The prey of the Bembecidae usually consists of the swift-flying, blood-sucking horse-flies or gad-flies (Tabanidæ) which are overtaken with ease on the wing.

Apoidea.

All bees are included in the super-family Apoidea and are distinguished from wasps by the plumose hairs in which their bodies are more or less clothed, and by the enlarged first joint of the hind tarsus or foot. The classification of bees is difficult and the whole system of classification has recently been revised. Formerly all bees were placed in one family, but now they are divided up into no less than seventeen families. There is no space to deal here with the characters that separate the various families.

HALICTIDÆ.

As is to be expected, the bees are very well represented at Kirstenbosch. Among the earliest of the solitary bees to appear in the spring are the little bronze-coloured Halictidæ (Figure 6). The female Halictus can be easily recognised by the groove on the dorsum of the last abdominal segment, up and down which the sting glides. Although these bees are solitary in the sense that each female prepares and stocks her own cells, without assistance, they are communal in habits, as many of them may nest in the same spot and may use a common entrance and burrow to give access to the cells which are constructed in side burrows below the ground. Each cell is stocked with a thick paste of honey and pollen, an egg is laid on the top of the paste, and the cell is closed. After consuming its store of provisions the larva spins a cocoon and pupates.

The great majority of bees provision their nests with a mixture of honey and pollen similar to that described for Halictus. Certain species are, however, "cuckoos" and lay their eggs in nests of other species of bees. There are also certain species that may be found burrowing in dried flower stalks of watsonias and gladioli that do not store up provisions, but which lay a small number of eggs at the bottom of the burrow and bring provisions to the grubs each day.

XYLOCOPIDÆ.

The largest conspicuous, carpenter bees (Xylocopidæ) that frequent the flowers of legumes dig neat round tunnels in rotten wood and partition off their cells, after stocking them with the usual honey and pollen paste, with neat partitions of wood fibres.

MEGACHILIDÆ.

The Megachilidæ (leaf-cutting bees), are big-headed, moderate-sized bees (Figure 7) that cut circular pieces out of leaves and construct neat, thimble-shaped cells from these. After completing the cell and stocking it, the mother closes it with a many-layered plug consisting of neat circles cut from leaves, and of exactly the right size to fit into the mouth of the cell. The leaf-cutter bee usually makes its cells in the discarded nests of other bees and wasps, or in holes in walls.

ANTHOPHORIDÆ.

The Anthophoridæ (Figure 8) are big, burly, hairy bees with remarkably long tongues. They may be seen darting restlessly from flower to flower in their unending search for nectar. They dig burrows in the ground and construct neat, smooth-walled cells that are stocked in the ordinary way.

APIDÆ.

The highest of all bees are, of course, the well-known hive bees. There are two distinct races in South Africa and both are common at Kirstenbosch. The little black hive bee, *Apis unicolor*, is credited with being fiercer than the slightly larger, yellow banded bee, *Apis adansoni*. These two races or varieties seem to cross freely, for both types are commonly found in one hive, and intermediates between the two are common.

CLASSIFICATION.

Order. **HYMENOPTERA.**
Two pairs of wings, membranous, connected with row of hooks on hind wings and fold on front wing. Mouth-parts with mandibles, the maxillae and labium formed into a lapping tongue. Metamorphosis complete.

Sub-order I. *Sessiliventres.*
No marked constriction between thorax and abdomen; thorax and abdomen approximately of equal breadth.

Super-family 1. **Tenthredinoidea.** Saw-flies.
Includes four families, CEPHIDAE, SIRICIDAE, CRYSSIDAE, and TENTHREDINIDAE.

Sub-order II. *Petiolata.*
Deep constriction between thorax and abdomen (really between first and second abdominal segments).

Super-family 2. **Cynipoidea.** Gall-flies.
Only one family CYNIPIDAE.

Super family 3. **Serphoidea.**
Two families of parasitic insects. PROCTOTRYPIDAE, PELECINIDAE.

Super-family 4. **Chalcidoidea.**
A very large group, including no less than twenty families of small. parasitic insects.

Super-family 5. **Ichneumonoidea.** Ichneumons.
Another large group of parasitic insects, divided into five families, ICHNEUMONIDAE, BRACONIDAE, EVANIIDAE, STEPHANIDAE, TRIGONALIDAE.

Super-family 6. **Chrysidoidea.** Ruby wasps.
Hairs on body simple, not branched or plumose. Abdomen with only three segments visible from above. One family, CHRYSIDAE.

Super-family 7. **Vespoidea.**
Hairs simple. Pronotum reaches tegulae (small plate at base of front wings). Ten families, BETHYLIDAE, DRYINIDAE. SCOLIIDAE, SAPYGIDAE, MUTILLIDAE, THYNNIDAE, POMPILIDAE, EUMENIDAE, VESPIDAE, MARSARIDAE.

Super-family 8. **Sphecoidea.**
Pronotum not reaching tegulae. Fourteen families, AMPULICIDAE, NYSSONIDAE, PSENIDAE, OXYBELIDAE, CRABRONIDAE, PHILANTHIDAE, TRIPOXYLONIDAE, MELLINIDAE, SPHECIDAE, LARRIDAE, ASTATIDAE, PEMPHRENDONIDAE, BEMBECIDAE, CERCERIDAE.

Super-family 9. **Apoidea.**
Dorsal hairs branched or plumose. First joint of hind tarsi enlarged. Fourteen families, HALICTIDAE, ANDRENIDAE, DUFOUREIDAE, NOMIIDAE, MACROPIDAE, PANURGIDAE, NOMADIDAE, EUCERIDAE, EMPHORIDAE, ANTHOPHORIDAE, HYLAEIDAE. COLLETIDAE, STELIDIDAE, MEGACHILIDAE, CERATINIDAE. XYLOCOPIDAE, APIDAE.

Super-family 10. **Formicoidea.** Ants.
First abdominal segment, and sometimes also the second, forming a knot or scale distinct from remaining abdominal segments. One family, FORMICIDAE.

Department of Public Education,
Cape Town.
January, 1924.

The Ferns of Kirstenbosch.

THE flowering plants of the Cape Peninsula are of such beauty and variety that they largely monopolise the attention of those who interest themselves in its wild flora; and the ferns are apt to be passed over unnoticed. And yet the Peninsula possesses a rich and diverse fern flora which is well worthy of study, and which forms the most refreshing contrast to the flowering plants. Out on the hillsides is the scrub vegetation with its rough dry foliage, its prevailing grey tint broken with patches of bright colour, bathed in the dazzling sunlight under the blue sky. But in the deep kloofs under the spreading dark green canopy of the forest, where all is cool and shady, and the air is moist, by the dripping krantzes and the clear brown streams, — this is the home of the ferns, soft and verdant, their tender fronds of a myriad graceful forms.

South Africa is mainly an arid country, and has been so for long ages, and its fern flora is not so rich as that of say, the Malay region or the Western Pacific. Dr. Sim in his fine work, "The Ferns of South Africa" (2nd edition, Cambridge, 1915,) enumerates 56 genera and 199 species of ferns (including Ophioglossales) occurring south of the Zambesi. Vast areas in South Africa are completely devoid of ferns, or merely contain one or two highly drought-resistant species such as *Pellaea hastata* of the grass-veld kopjes, or *Cheilanthes hirta* of the Karoo. The great majority of the species are confined to the forest areas of the coastal districts, from the Cape Peninsula to the Zambesi mouth.

The Cape Peninsula possesses a very representative sample of this fern flora, 25 genera and 53 species occurring:

or nearly half the genera and rather more than a quarter of the species. It is interesting to compare these figures with the corresponding ones for Great Britain and Ireland, in which islands we only find 17 genera and 38 species, or about two-thirds of the Peninsula fern flora.

The majority of the Peninsula ferns occur wild in Kirstenbosch and the Upper Kirstenbosch Nature Reserve, this being on account of the high rainfall and the rich development of forest in the ravines, with moist atmospheric conditions as a consequence. Up to the present 19 genera with 35 species* of ferns are known in the Kirstenbosch area, and two or three others are suspected to occur. That is, in the 1100 acres of Kirstenbosch there are more genera than, and almost as many species as in the whole of the British Isles.

Vegetative Features

The Ferns are plants normally differentiated into roots, stems and leaves. In the great majority of cases the leaves are of large size relatively to the stem: this is very noteworthy when they are compared with such plants as the Lycopodiums and Selaginellas, which are also spore-bearing plants, but which have relatively small leaves. The leaves of some ferns are simple in form, linear as in our Schizæas or oval as in *Polypodium lanceolatum* and our Elaphoglossums. In most species, however, the leaves are more or less divided. In the Peninsula ferns the divisions are always variations on the pinnate plan, the frond being once, twice, thrice, or four times pinnate or pinnatifid (the latter term being used when the divisions are deep but do not reach the rachis).

The main axis of the frond is often called the stipe, below the lamina; and any axis to which the pinnae or pinnules are attached is called a rachis. The lamina is usually thin, sometimes exceedingly thin, as in the "filmy" ferns whose leaves are often almost transparent and wither at once in dry air; sometimes coriaceous or leathery as in *Elaphoglossum conforme*.

Succulence is exceedingly rare in ferns, and no South African species shows it: even in the arid regions, where so many families of flowering plants are represented by succulent species, the few ferns that exist have thin fronds. Xerophytism, when it occurs, is brought about in other ways: by a coating of chaffy scales as in *Ceterach cordatum*, or hairs as in *Cheilanthes hirta*, or wax as in *Pellaea hastata*, or cuticle as in *Elaphoglossum conforme*.

The stems are also of various types. In the tree ferns the stem is an erect trunk some inches in thickness scarred with the marks of the fallen leaf-bases. In the little filmy ferns the stem is hardly thicker than a horsehair, and creeps on the surface of the rocks or soil or among mosses. The stems in other ferns lie between these extremes. In *Hypolepis sparsisora* the stems are as thick as a pencil, and the leaves are attached at distances of several inches. *Todea barbara* has a stem as thick as a finger, but apparently arm-thick owing to the dense armour of persistent leaf-bases. In the local species of Asplenium, Polystichum and Dryopteris (except *Dryopteris Thelypteris*) and in many others, the stem is short and clad with old leaf-bases, and bears the leaves in a symmetrical crown. In *Dryopteris Thelypteris*, *Polypodium lanceolatum* and others the leaves are all borne on one side of the stem. In practically all cases the stem is covered, at least in the young parts, by a dense coating of chaffy scales, which serve as a protection from the rough soil particles.

The anatomical structure of the stem is of great interest and variety, but to consider it fully would be outside the scope of this article. It may be pointed out, however, that in Gleichenia we find the conducting tissues in a solid central strand in the stem: in Hypolepis they form a tube enclosing a pith: in *Dryopteris Thelypteris* and many others they form a tubular network which appears in a cross-section as if it were a ring of distinct conducting strands: in Pteridium the strands are scattered and in Hemitelia they are folded in many ways. The stipe of the leaf has also an interesting structure. In Todea a cross-section shows the conducting strand arranged in the form of a horseshoe: and practically all fern petioles have either this form or a more or less evident modification of it.

The roots are always of the kind known as adventitious: they are borne directly on the stem, and there is never any extensive branching tap-root such as is found in most dicotyledonous flowering plants. One result of this is that the ferns are in general very shallow rooted, and this combined with their non-xerophilous leaves makes them typically plants of moist situations. In some cases, e.g. *Pteridium aquilinum*, the stems and consequently the roots live several inches or a foot deep in the soil, and this feature combined with the possession of a rather thick cuticle and a hairy under surface* to the pinnules enables the bracken to flourish in relatively dry localities. In some of the Sahara species of Cheilanthes the roots excrete a mucilage which cements together the sand particles, forming a sandstone tube within which the roots live like a caddis-worm in its case: it would be interesting to see whether any of the South African dry-country Cheilanthes have the same peculiarity.

*Excluding *Vittaria iscetifolia*, and counting *Asplenium lunulatum* and its var. *erectum* as two distinct plants.

*In the South African variety, the European bracken having practically glabrous pinnules.

Life History

The Ferns exhibit very clearly a phenomenon, known as the alternation of generations, which is found in all plants above the level of the Algæ and Fungi. In the Flowering Plants this phenomenon is apparent to none but the botanist who has microscopically studied the stages in the development of the ovule: but in the Ferns it is, or can be, recognised by everybody. But this very ordinary occurrence in the plant's life history comes as a great surprise to those who meet with it for the first time.

The fern-plant, as everybody knows it, is a good-sized organism with a more or less extensive stem, roots and relatively large leaves. It lives usually for many years, producing a succession of leaves, some or all of which bear reproductive organs, the sporangia: the function of the sporangia being to produce large numbers of fine dust-like spores which are scattered by the wind. The fern plant never shows any kind of sexual reproduction whatever: the spores are produced, as it is expressed, asexually.

Now these dust-like spores, after falling into a suitable situation, usually one with abundant moisture in the soil and air, germinate. But they do not produce a new fern plant, as might perhaps be expected. Instead, the spore forms a little thin dark-green semi-transparent disc seldom as large as a threepenny piece, often notched at one side and spread out flat on the ground to which it is attached by numerous very slender hair-like rhizoids. This prothallus, as it is called, possesses no true roots, nor is it differentiated into stem and leaf. Prothalli can often be found on moist earth banks in partial shade by the edge of streams in places where ferns abound: but a little experience is necessary before they can be distinguished with certainty from certain Liverworts or Hepaticae, which they somewhat resemble.

It is the function of the prothallus to produce the sexual reproductive organs and to bring about fertilisation. This consists in the fusion of a stationary egg-cell, borne in a special receptacle, with an actively swimming sperm-cell.* When this sexual fusion has taken place, the fertilised egg-cell begins to grow, and develops into a typical fern-plant with roots, stem and leaves. One can often find the very young fern-plant still attached to the prothallus, before the latter has withered and before the young "sporeling" has had time to establish itself.

Thus there is an alternation, perfectly regular and normal, in the life history between an asexual generation (the fern plant) and a sexual generation (the prothallus).

The prothalli do not in general furnish good characters by which to discriminate between species, and for this reason as well as for practical convenience, they are largely neglected by systematic botanists.

Spore Production

All ferns produce large numbers of minute spores, these being singly invisible to the naked eye. Under a good lens or a microscope the spores are seen to be roughly spherical objects, usually brown in colour (green in Todea and some others). If a fern frond, which is in the condition of liberating spores, be laid on a sheet of white paper, myriads of spores forming a soft fine dust will be deposited. The spores are very light and powdery and are easily scattered by wind: when they reach a suitable situation they germinate and so bring about the spread of the species. Of course millions of spores are wasted for every one that can germinate; and this enormous wastage is a feature common to most plants and animals that depend on casual wind and water currents for their dispersal. (Compare the pollen of the pines and the vast numbers of seeds of orchids.)

The spores are produced in special organs called sporangia. These are easily visible without a lens, and in some cases (e.g. Todea, Mohria) are individually rather conspicuous. They are produced in great numbers on the lower surface or on the margins of the frond, being either scattered or arranged in clumps of various shapes, and they are usually protected when young by some device or other. The most usual kind of sporangium is a capsule borne on a stalk: the capsule is usually shaped like a rather thick watch, i.e. round but with flattened sides: the stalk is slender and elongates when the capsule is ready to discharge its spores. Around the edge of the sporangium is a special spring-like "annulus" which comes into action when the sporangium is ripe and dries up: the spring then suddenly flies backwards, tearing the capsule across, and flinging out the dry powdery spores into the air. This process can easily be watched under a good lens or a microscope. If a few ripe but unbroken sporangia are scraped off the frond on to a piece of paper or a glass slide, they will dry quickly and can be seen exploding. In most ferns there are about 32 spores in each sporangium, but in Gleichenia there may be several hundred. In Hymenophyllum and Hemitelia the sporangia are somewhat similar to the above described type but the annulus is slightly oblique. The sporangium of Todea is of a different shape, being almost spherical and without a long stalk: when ripe it splits across

*It is seldom known, except by botanists, that free-swimming sperms exist in the Mosses and Ferns, and even in such highly elaborate plants as the Cycads. These cells propel themselves through the water by vigorous lashings of fine thread-like appendages, and are conducted to their destination by chemical attraction.

the top into two halves: and that of Mohria is somewhat similar. In Schizaea the sporangium is somewhat pear-shaped, the annulus forming a girdle around the narrower end, and the stalk being attached to the side of the broader end. Gleichenia has an asymmetrical sporangium with an oblique annulus. These differences in the sporangia are very important in considering the relationships of the ferns among themselves, that is in their classification: the grouping of ferns into families being largely guided by these features.

Another important subject is the way in which the sporangia are grouped, and whether or not there is any special protective device or "indusium": and these features are the principal ones upon which the different genera of ferns are distinguished. In Elaphoglossum the sporangia are uniformly and densely scattered over the lower surface of the fertile frond (except the midrib and margin), and there is no indusium. In Polypodium the sporangia occur in circular groups or sori, often sunken in depressions in the frond, but without indusium. In Polystichum the sori are also round, and each is protected when young by an umbrella-shaped indusium: when the sporangia are ready to shed their spores they protrude from under the indusium, and the latter often withers and falls off completely. In Dryopteris the indusium is attached at one edge and is roughly kidney-shaped. In Asplenium the sorus is elongated, a few times as long as it is broad, and is covered by a flap-shaped indusium attached by one edge. In Blechnum the sorus is similar, but much longer, and lies parallel with the pinna margin, there being one on each side of the midrib.

In several genera the leaf margin is recurved over a marginal sorus or line of sporangia, and acts as a false indusium. This is the case in Pteris, Pteridium, Pellaea, Cheilanthes, Hypolepis. Adiantopsis, and Adiantum: these genera being distinguished by differences in the position of the sporangia, whether the sori are continuous or interrupted, and so on.

In most ferns any frond appears to be capable of bearing sporangia: but in a considerable number of cases there is a distinction between fertile and sterile fronds; or sometimes between fertile and sterile pinnae on the same frond.

Conspicuous examples are provided by Blechnum: in this genus the sterile fronds have broad green pinnae adapted for carbon-assimilation, but the spore-bearing fronds have much narrower pinnae, the lamina being greatly reduced in breadth. In *Elaphoglossum conforme* the fertile frond is usually smaller and is borne on a longer stipe than the sterile frond. In *Mohria caffrorum* the sterile fronds are produced early in the season and spread out horizontally: the fertile fronds are produced later, stand erect, are taller and narrower and have less lamina. *Dryopteris Thelypteris* has also a somewhat similar difference between sterile and fertile fronds, the latter being liable to be taken for a distinct species.

Vegetative Propagation

Many ferns propagate themselves by vegetative means. This is specially the case with such social ferns as the bracken, *Hypolepis sparsisora*, *Dryopteris Thelypteris*, and *Adiantum Poiretii*, which have long quickly-growing rhizomes, and which may colonise large areas without spore-reproduction taking place. Ferns with short stocky stems cannot spread in this way, and rely on spore-germination.

An interesting method of vegetative propagation is that well known in the so-called "mother-fern" *Asplenium bulbiferum*, and which is occasionally shown by our local species of the same genus, (e.g. *Asplenium monanthes*, *Asplenium lunulatum*) when growing in very moist conditions. In these cases buds arise on the frond, and develop into small leafy plants while the parent frond is still green: when the latter withers and falls on the ground, the buds put out roots and thus a colony of daughter-plants is established.

Collecting and Identification

The Ferns of the Cape Peninsula are a very attractive group to collect and identify. Practically all of them dry quickly between papers under pressure, and they make very beautiful herbarium specimens. In the case of the filmy ferns, it is necessary to keep the plants in a water-saturated atmosphere until they can be put into paper, and in fact most ferns shrivel quickly if left exposed to the dry air or sun after gathering.

In collecting specimens for identification be careful to take fronds complete (including the whole length of the stipe) — except of course in such a case as Hemitelia. Make sure that the fronds possess sori; and look carefully to see whether indusia are present, for these often fall off very early and easily: it is often necessary to examine and collect very immature sori to show this feature. Take a piece of the stem where possible, and make notes about it. When there are distinct sterile and fertile fronds collect both. Make notes as to the exact habitat, locality, altitude, aspect and date of collection.

For the purpose of naming the ferns which are found growing wild in the Cape Peninsula the following Key will be useful. It is to some extent an "artificial" key, because the sporangial characters which are used for distinguishing families can only be studied by the microscope, and the key is intended for field use: less essential though obvious characters have therefore been used to separate the species in many cases. Certain ferns may be found which do not "run down" satisfactorily: this is an imperfection

common to all keys, and is often due to extreme local variation under unusual conditions. To guard against this the specimen collected should be as normal and average a one as can be found; obvious freaks or extremes should be avoided for this purpose. On the other hand, it is quite possible that species new to the Peninsula may be discovered: and the key may give an inkling that this is the case. If so, Sim's "Ferns of South Africa" with its full descriptions and figures should be consulted, and an opportunity taken of matching the specimen in a Herbarium. Outside the Cape Peninsula the Key will be of less value, its usefulness decreasing with increasing distance.

The ferns already known to grow wild in the Kirstenbosch area (including the Upper Kirstenbosch Nature Reserve) are indicated by an asterisk. I should be very glad to hear of any new records for this area, and indeed for the Peninsula generally.

ARTIFICIAL KEY TO THE FERNS OF THE CAPE PENINSULA.

(1) Sporangia on under surface or margin of frond, scattered or arranged in sori, or on special pinnae 2
Sporangia in two rows embedded in a special simple spike 49

(2) Fronds filmy; indusium cup-shaped or 2-lipped. marginal 3
Fronds not filmy; indusium not cup-shaped nor two lipped 7

(3) Frond hairy **Hymenophyllum Mariothii***
Frond glabrous 4

(4) Pinnules entire 5
Pinnules finely serrate 6

(5) Indusium cup-shaped, sometimes slightly 2-lipped **Trichomanes pyxidiferum**
Indusium conspicuously 2-lipped **Hymenophyllum fumarioides***

(6) Frond 6-9 inches long **Hymenophyllum uncinatum**
Frond an inch or two long **Hymenophyllum tunbridgense***

(7) Plant annual; fronds delicate, compound, 1-3 inches long **Anogramma leptophylla***
Plant perennial; fronds usually more than 3 inches 8

(8) Markedly arborescent, trunk several feet high **Hemitelia capensis***
Not arborescent or with a very short trunk only 9

(9) Frond simple 10
Frond variously lobed or divided 15

(10) Frond very slender, linear or grasslike 11
Frond with ovate or elliptical lamina 13

(11) Sori linear, parallel with margin of frond **Vittaria isoetifolia**
Sporangia borne on special lobes forming a compact crest at apex of frond 12

(12) Frond very slender, about $\frac{1}{32}$ inch in width, and usually with less than 10 pairs of fertile lobes in the crest, which is nearly straight **Schizaea tenella***
Frond rather rigid, about $\frac{1}{16}$ inch wide, with 10 or more pairs of fertile lobes in the curved crest **Schizaea pectinata***

(13) Sporangia densely scattered on special fertile frond 14
Sporangia in round naked sori **Polypodium lanceolatum***

(14) Frond thick and leathery **Elaphoglossum conforme***
Frond thin and herbaceous **Elaphoglossum petiolatum**

(15) Frond normally simply pinnate or pinnatifid, the pinnae entire (more or less bipinnate as an abnormality) 16
Frond not simply pinnate, or if pinnate the pinnae lobed or toothed 21

(16) Sporangia in round naked sori **Polypodium vulgare**
Sporangia in linear sori on special fertile fronds, parallel with the margins 17

(17) Sterile pinnae attached by broad base to rachis 18
Pinnae with narrow attachment to rachis 19

(18) Not arborescent; pinnae long acute; base of stipe almost without scales .. **Blechnum attenuatum***
Usually with short trunk; pinnae blunt; base of stipe with many long scales .. **Blechnum tabulare***

(19) Pinnae 1-1½ inches long, markedly auricled; sori well within the margins .. **Blechnum australe***
Pinnae 2-5 inches long; sori almost marginal 20

(20) Pinnae on short petioles, 3-5 inches long, often overlapping; no reduced pinnae at base of frond **Blechnum capense***
Pinnae 2-3 inches long, sessile, the basal pinnae much smaller **Blechnum punctulatum***

(21) Sori more or less covered by reflexed leaf margin 22
Sori well within the leaf margin which is not reflexed over them 35

(22) Sporangia large and solitary, near leaf margin which is slightly recurved .. **Mohria caffrorum***
Sporangia small, aggregated in sori 23

(23) Leaf margin reflexed here and there, forming a number of separate indusia 24
Leaf margin reflexed continuously or almost so, acting as an indusium 29

(24) Sori very small, isolated; frond large on elongated creeping rhizome **Hypolepis sparsisora***
Sori not very small, often adjacent; frond of various size; rhizome various 25

(25) Sporangia borne on the under side of the reflexed leaf margin (indusium) 26
Sporangia on the leaf itself or at the line of reflexion of the margin.

(26) Each pinna with one, or rarely two, curved indusia **Adiantum Poiretii***
Each pinna with several indusia 27

(27) Indusia nearly straight: pinnules cuneate at base **A. capillus-veneris**
Indusia curved: pinnules rounded at base **A. aethiopicum***

(28) Frond very hairy **Cheilanthes hirta**
Frond glabrous 29

(29) Indusia closely set all round margin of pinnules. ciliate; frond up to about 4 inches long **Adiantopsis capensis***
Indusia more distant, not ciliate; frond 5 inches to a foot long **Cheilanthes multifida**

(30) Sporangia borne on the frond in a line covered by the indusium 31
Sporangia borne exactly in the axil of the reflexed leaf margin 34

(31) Frond almost simply pinnate or 2-pinnatifid **Pellaea auriculata**
Frond twice or thrice pinnate 32

(32) Pinnules sessile **Pellaea viridis**
Pinnules distinctly stalked 33

(33) Pinnules oval, dark green **Pellaea pteroides***
Pinnules cordate or hastate, glaucous **Pellaea hastata**

(34) Frond pale glaucous green, thin, glabrous; veins anastomosing in the largest pinnules **Histiopteris incisa***
Frond dark green, robust 35
(35) Ultimate pinnules finely toothed where sterile, glabrous **Pteris dentata***
Pinnules not finely toothed; rachis and underside of pinnules hairy .. **Pteridium aquilinum***
(36) Frond forking repeatedly, with an aborted bud in most of the forks .. **Gleichenia polypodioides***
Frond without aborted buds 37
(37) Sporangia relatively large, sessile in dense irregular masses without indusia .. **Todea barbara***
Sporangia small, distinctly stalked, in definite sori with or without indusia 38
(38) Sori more or less oblong or elongated 39
Sori circular or kidney-shaped 46
(39) Indusium absent 40
Indusium present 41
(40) Frond densely covered with reddish scales on the lower surface **Ceterach cordatum**
Frond villose **Dryopteris africana**
(41) Frond almost simply pinnate 42
Frond 2- or 3-pinnate or pinnatifid 44
(42) Each pinna with several sori 43
Each pinna with a single sorus parallel with the lower margin (Occasionally extra sori) **Asplenium monanthes***
(43) Pinnae pointed, deeply toothed **Asplenium lunulatum var. erectum***
Pinnae rounded at apex, crenate **Asplenium lunulatum***
(44) Pinnae acutely toothed .. **Asplenium praemorsum***
Pinnae not acutely toothed 45
(45) Stipe slender, green; frond 3 inches long, 1- to 2-pinnate **Asplenium Rawsoni**
Stipe stiff, dark; frond 3-9 inches long, 2- to 3-pinnate .. **Asplenium adiantum-nigrum***
(46) Indusium circular, peltate 47
Indusium kidney-shaped, often very fugacious 48
(47) Pinnules with bristle-pointed teeth **Polystichum aculeatum***
Pinnules with blunt lobes **Polystichum adiantiforme***
(48) Frond 4-pinnatifid, with scaly rachises and sharply toothed pinnules **Dryopteris elongata***
Frond pinnate or 2-pinnatifid, the pinnules with blunt lobes 49
(49) Fronds distantly inserted on rhizome, glabrous, light green **Dryopteris Thelypteris***
Fronds closely set on rhizome, the rachis at least being hairy **Dryopteris Bergiana***
(50) The narrow sterile frond and the fertile spike distinct to the base **Ophioglossum Bergianum**
Fertile spike inserted on sterile frond or on its stipe 51
(51) Sterile frond linear-lanceolate, 1-3 inches long **Ophioglossum lusitanicum**
Sterile frond ovate with a long stipe **Ophioglossum capense**

NOTES ON KIRSTENBOSCH SPECIES.

The following notes as to the habitats, localities and special points of interest of the ferns found wild in Kirstenbosch may be of use to nature-students. Other localities doubtless exist in most cases. The order and the numbers are the same as those given by Sim (2nd edition).

5. *Hymenophyllum fumarioides.* The delicate light green fronds may often be found hanging from wet rocks and roots in deep shade. Skeleton Gorge, Root Ladder, etc.

7. *Hymenophyllum Marlothii.* Only four localities known in the Peninsula, one being in Kirstenbosch. Deep shade and constant moisture. Forms rusty-looking masses on vertical surfaces.

10. *Hymenophyllum tunbridgense.* Abundant in the gorges on the surface of boulders and roots. Distinctly less moisture-demanding than the other species, though often associated with them: resists drying up, reviving on the return of moisture. In all the wooded gorges.

13. *Hemitelia capensis.* The only tree-fern (if *Blechnum tabulare* be excepted). Trunk reaches a height of nine or ten feet in the well-known grove in Window Gorge. Abundant in Window and Skeleton Gorges in moist shady situations. The majority of the plants have short trunks. Remarkable for the curious *aphlebiae* or delicate appendages on the base of the stipe: these are green when young and closely resemble the frond of a filmy fern; they quickly turn brown and form a fuzzy mass protecting the growing-point of the stem. They were first recorded as an epiphytic species of Trichomanes. The trunks are relatively slender and are often bent, and the large fronds are much more delicate and graceful than those of the up-country tree-fern *Cyathea Dregei.*

17. *Dryopteris Bergiana.* Has been collected in Kirstenbosch, but appears to be scarce. I cannot give a precise locality.

24. *D. Thelypteris.* Swampy stream-sides in the open or in partial shade. Grows socially, owing to its elongated rhizomes. The fronds are often 2-3 feet in length and are strongly scented. Grows in the streamlet from the Kaffir-boom Hill, just above Skeleton Path.

27. *D. elongata.* Occasional in the forests. Easily known by its 4-pinnatifid fronds.

36. *Polystichum aculeatum.* Easily known by its bristle-pointed serrate pinnule-margins Window Gorge, near Contour Path, on moderately dry slopes in shade.

39. *Polystichum adiantiforme.* Remarkable for its large peltate indusia. Occasional in rocky places at about 2500 ft., e.g. in Ash Valley.

58. *Asplenium monanthes.* A delicate little fern, easily recognised by the single sorus on each pinna. Occasional in Nursery Gorge and in Skeleton Gorge above the Contour Path, in the forest shade.

59. *A. lunulatum.* Occurs in the gorges, especially at high altitudes. It appears to be quite distinct from the var. *erectum*, and there is no obvious reason why the two should not be regarded as distinct species.

59. *A. lunulatum var. erectum.* Frequent in all the gorges, as isolated plants; from about 1000 ft. upwards. Pinnae toothed along both edges.

73. *A. adiantum-nigrum.* Dry rocky slopes in forest shade. Window Gorge, Celtis Glade.

76. *A. praemorsum.* Easily known by its sharply cut leaf-margins. The fronds are rather flaccid, often drooping on the ground. Forest shade among rocks in the gorges, between 1000 and 2000 ft.

86. *Blechnum attenuatum.* Frequent in gorges, favouring the banks of streams and dripping rocks, from the Gardens to the Lower Plateau. Young fronds often vividly red. Easily known by the broad-based pinnae.

87. *B. punctulatum.* Damp places, among rocks by streams. Often confused with *B. australe.* Nursery Stream above Contour Path whence came the plants round the Bath.

88. *B. capense.* A large handsome fern, abundant in the Swamp Garden and in moist earth by streams. Pinnæ usually marked with transverse brown streaks of unknown nature.

89. *B. tabulare.* Has a distinct erect or prostrate trunk, a few inches or a foot or two high. Grows in groups under the shade of rocks in moist situations, especially at or above 2,000 ft., e.g. at foot of Castle Rock on its south side.

90. *B. australe.* Very common on moderately open dry stony slopes, away from streams. The smallest Blechnum in Kirstenbosch. Occurs chiefly at fairly low altitudes, e.g. Window Gorge.

93. *Anogramma leptophylla.* Sim mentions two South African localities for this interesting fern, one in Waterfall Ravine (Devil's Peak), the other in Rhodesia. It has recently been found on the Contour Path, close to where it crosses Nursery Gorge. The whole plant is only an inch or two in height, and is annual — a very rare condition among ferns. The remains of the prothallus can often be seen even when the fronds are bearing sporangia. The plant disappears completely at the onset of summer, passing the dry season in the form of spores, which germinate and form rather large prothalli at the first good winter rains.

110. *Pellaea pteroides.* A handsome fern. occurring in bushy places, forest margins, etc. Contour Path by Nursery Stream, etc.

114. *Adiantopsis capensis.* Scarce on open dry slopes in Kirstenbosch. Much commoner on the Malmesbury beds, e.g. on Lion's Rump.

127. *Hypolepis sparisisora.* One of the most graceful of our ferns. The rhizome is greatly elongated and trails over the ground. The fronds are light green, much divided and three or four feet in length. Occurs in broad masses in moist earthy streamsides; e.g. Skeleton Gorge at Contour Path, and Rooikat Stream below Constantia Nek Road.

137. *Adiantum Poiretii.* Grows in spreading social masses on earthy banks in shade of bushes and herbaceous plants. Behind the gum-belt on the right bank of Nursery Stream.

138. *Adiantum aethiopicum.* Occurs as individual plants in forest shade, e.g. just above Contour Path between Skeleton and Window Gorges. The only known locality in the Western Province, (see Sim, p. 354.)

143. *Pteris dentata.* Rare in Kirstenbosch, but abundant in Cecilia Gorge, just outside our boundary. A very handsome fern, with fronds up to four feet tall. Window Gorge, near Tree Ferns.

149. *Histiopteris incisa.* Here and there in moist semi-shade, especially at higher altitudes, e.g. foot of Castle Rock. The crucial character of this rather " thin " genus, the anastomosing veinlets, can only as a rule be seen in the larger basal pinnules, against the main rachis.

150. *Pteridium aquilinum.* The abundant bracken fern of the dry slopes. Comes up abundantly on Silver Tree Ridge after clearing or fires. The rachis and under side of pinnæ are distinctly hairy, this being the only noticeable difference from the bracken of the northern hemisphere. Almost the only fern that becomes a serious weed in gardens.

152. *Vittaria isoetifolia.* A specimen in the Bolus Herbarium was collected by Dr. Bolus above Klaassenbosch at 2,300 ft. It is not clear whether this was within the present Upper Kirstenbosch Nature Reserve. I have repeatedly searched among the rocks at this altitude. but without finding this curious fern, with its inconspicuous grass-like fronds.

161. *Polypodium lanceolatum.* Our only habitually epiphytic fern. Abundant on the oak trunks in Window Gorge: also on mossy stones and stumps by the streams. The leaves wither readily in dry weather, but revive after a good rain.

167. *Elaphoglossum conforme.* Vertical wet rocks, especially at moderately high altitudes. Foot of Waterfall, Window Gorge. The other species, *E. petiolatum*, will probably be found in Kirstenbosch: I have met with it in Newlands Ravine at about 1,800 ft., in open situations.

177. *Gleichenia polypodioides.* Frequent in moist rock crevices, e.g. on Castle Rock. Sometimes forms dense bushy masses, as at the waterfall above the Contour Path in Diamond Stream.

180. *Schizaea tenella.* This very inconspicuous fern has been found in several localities in the Peninsula. It

occurs on the rock-ledges on the south side of Skeleton Gorge at about 2,200 ft.

181. *S. pectinata.* Abundant on Silver Tree Ridge and in dry open or bushy places as high as the Lower Plateau. A most " un-fern-like " plant, suggesting a reed, but even the sterile fronds are betrayed when young by their beautiful crozier-like vernation.

185. *Mohria caffrorum.* Soft pleasantly scented fronds, the sterile ones spreading, the fertile ones erect. Abundant in semi-shade on open slopes. Dries off completely in summer, except in sheltered situations. Contour Path, etc.

190. *Todea barbara.* A noble fern, occurring at all altitudes in fair moisture, and varying greatly in stature and luxuriance according to the degree of shade. A magnificent specimen in the Swamp Garden: frequent at the top of Nursery and Skeleton Gorges.

R. H. COMPTON.

Kirstenbosch.

February, 1924.

Cultivation of South African Ferns.

IN the Society's Journal for 1919 some observations were given on the conditions under which Karroo Ferns and Filmy Ferns were found in a wild state, from which the aspirant to their cultivation would be able to deduce the requirements to be satisfied to obtain success. A dry atmosphere; strong light, even sunshine; a well drained sandy loam constantly somewhat dry were indicated as the conditions required by the Karroo Ferns. Heavy shade; a still, moisture laden atmosphere, and constantly trickling water among the roots were the controlling factors in the cultivation of the Filmies, one of the most interesting classes of plant life. " Filmy " describes the nature of the fronds, which are transparent or pellucid, and membranous. This character, the degree of transparency, is a good index to the amount of shade a particular plant will require whether fern or not, and implies a soil mainly composed of humus and often with an abundant supply of moisture at the root and in the air. In various types of plants, as Liparis and Dermatobotrys, this character is present under the same conditions but with a less supply of moisture. These last have occasionally been termed Saprophytes, but as this term is already in use for a quite distinct class of plants, it has been suggested they should be called " Humiphytes," which fits the class exactly, and within this class come the main body of ferns, differing in the individual requirements only as they differ in their appearance. At the one extreme there are the Xerophytic ferns of the Karroo with their furry or glaucous and coriaceous fronds. Between these we get Ferns of all gradations from the one to the other; a few Epiphytic, but mostly Terrestrial. To the actual collector of ferns, as well also of other plants, it is easy to note the three conditions — composition of the soil, amount of moisture in soil and air, and the aspect as denoting the amount of shade. The would-be cultivator who has not had the advantages of collecting has to deduce the necessary conditions from the plant itself. To the profound student of Fern Life the second edition of Dr. Sim's Ferns of South Africa is a ready help from whatever point they are studied, bearing always in mind that conditions therein have been noted mainly under a summer rainfall, whereas there is some divergence in the conditions under which particular species thrive in the heavy winter rainfall of the Cape Peninsula. A prominent feature in the edition is the alteration of names occasioned by new views as to the definition of genera and by the laws of priority. Our old friend *Nephrodium molle* is now *Dryopteris mollis* The ubiquitous Bracken is *Pteridium aquilinum* instead of *Pteris aquilina* of the last half century. *Aspidium capense*, the " Six Weeks Fern " of Table Mountain, is *Polystichum adiantiforme;* and so on, ad lib. As far as possible the names of the second edition will be followed in the hope that practice will make perfect.

The uses to which native ferns can be put are many and varied. Most of the Pteris, Adiantums, Aspleniums, Blechnums, etc., natives of the Cape Province, are hardy and robust, and largely resistant to a dry atmosphere. They thrive well on stoeps, and for indoor decoration, after growth is complete, can be used for lengthy periods without detriment to their future well-being. The northern and Rhodesian species require the shelter and warmth of a greenhouse to secure and maintain perfect health, and can be used only for short periods for indoor decoration. For large wire hanging baskets in sheltered and shady corners of a stoep, the strong growing rhizomatous ferns, *Hypolepis sparsisora*, *Histiopteris incisa*, *Microlepia speluncae*, *Nephrolepis exaltata*, etc., will be found very luxuriant with a regular and copious supply of water, but all dislike wind and a dry atmosphere. *Gleichenia polypodioides* is of a similar habit and requirements at the roots, but resents root

disturbance and is consequently difficult to establish. When once secured it makes a fine mass of elegant foliage. It prefers full light, even sunshine, if root moisture is abundant, and a free buoyant atmosphere. *Dryopteris thelypteris*, with thin wide spreading rhizomes may be grown on dead tree fern stems or as basket plants if the rhizomes are pegged down until well established. All the above creeping ferns are bog or stream-side plants, varying only slightly in the amount of water they require.

A very distinct and rampant fern is *Stenochlaena tenuifolia*, a semi-epiphyte, which usually starts life at the base of a tree, and by means of its roots climbs to considerable heights. It requires full shade, and a constant supply of moisture.

The short-rhizomed ferns are sharply divided into "dry" and "wet" loving plants. *Polypodium ensiforme*, *P. lineare*, *P. lycopodioides*, etc., are epiphytic on trees or rocks, relying solely on rainfall for their moisture, and resting over long periods in its absence. These may be grown in orchid baskets of peat or on blocks of teak, or any other hard wood. A constant supply of water is required during growth, but when at rest sufficient only to prevent the plants shrivelling up as they often do under natural conditions. All withstand strong light, even sunshine, but under cultivation are best in partial shade. The Elaphoglossums may be termed the "Wet" Polypodiums, as healthy plants are only maintained with an abundance of water and full shade. Growing in orchid baskets of peat permits of constant dipping — the only satisfactory way of watering hanging baskets of any kind.

Other moisture loving ferns are the miniature or dwarf tree-ferns — *Todea barbara*, *Blechnum tabulare*, *Osmunda regalis*, *Didymochlaena truncatula*, *Dryopteris prolifera*, etc. The Todea and Osmunda withstand full sun, but the others demand shade and shelter. The Didymochlaena under pot cultivation in the greenhouse is a perverse subject persisting in dropping its pinnæ as a result of the attentions of thrip and red spider.

The large tree ferns, *Cyathea Dregei*, and *Hemitelia capensis*, agree in their love of moisture at the roots, but differ in atmospheric requirements. The Cyathea withstands a fair amount of wind and sun, whilst the Hemitelia must have complete shade and shelter combined with a moisture-laden atmosphere. Similar conditions suit *Marattia fraxinea*, a rather massive wide spreading fern of a succulent nature.

The Lygodiums are twining ferns of considerable length, and are seen to the best advantage trained on plain wires on the back walls of a stoep or the ends of a shady greenhouse.

Of the Adiantums, *A. aethiopicum* is of easy cultivation in pots or pans in the greenhouse. *A. Poiretii*, the maidenhair of the Peninsula flower sellers, is almost dormant throughout the summer, and being very tender is not altogether satisfactory under cultivation. *A. lunulatum* and *A. caudatum* are very distinct and choice plants for small hanging baskets in a warm greenhouse. They develop young plants at the ends of the narrow arching fronds that hang on and continue to grow for a long time, and give quite an unique appearance.

Asplenium is the largest genus, and embraces species with fronds ranging from the stiff coriaceous pinnæ of the Xerophytes to the soft transparent pinnæ of the Filmies.

Among the pigmies of the order *Actiniopteris australis* is distinct and effective when planted thickly in a well drained pan. It is partial to full light, and would thrive on the shady side of a dry wall, or on rock crevices in the open. *Elaphoglossum spathulatum* is a quaint little gem partial to damp mossy rocks; and *Vittaria isoetifolia*, resembling a hanging bunch of grass more than an ordinary fern, is epiphytic in small holes in rocks, and on trees.

Quite a large number of our native ferns withstand drought at the root and in the air during their period of rest, (if sheltered and shaded from wind and sun). Various species of Asplenium, Cheilanthes, Blechnum, and Pellaea, *Polystichum adiantiforme*, and *Pteris cretica* are examples. In the Western species of our bushy hillsides and slopes this takes place during summer. Under cultivation it is advisable to supply sufficient moisture to maintain a healthy appearance in the fronds of an evergreen character. Conversely the period of active growth is in winter and spring, when abundance of water is required. The ferns of shady and wet places and stream-sides grow most freely during summer, and rest somewhat in autumn and winter.

In planting out or repotting it is advantageous to have the work completed prior to the commencement of visible growth, as activity of the root system always precedes the development of new fronds. In a comprehensive collection of ferns native from the Peninsula to the Zambesi, replanting would extend from March to September, with the maximum amount in those two months.

As with the re-potting or transplanting of all plants, so with ferns — they must be prepared for the operation. The day before it is intended to do the work examine the soil for moisture — if dry give a good watering — if too wet in pots, knock them out, remove the drainage, and put them back loosely to allow them to dry out; not so dry as to have lost all cohesion and fall to dust when the roots are loosened, nor so moist as to be sticky. The new compost for potting must be brought to this condition also, and

planting out should be done only when the soil is in a similar moist friable condition. The soils used for making composts are leafmould, peat, loam and sand. The important point is the ratio of the one to the others as required for particular species. In the absence of peat partially decomposed leafmould is the best substitute.

Epitomised it may be said:—

Epiphytic ferns require a clean peat as a rooting medium.

Xerophytes, and all sturdy growers 2 parts of leafmould, 2 of loam, and 1 of sand

Dry Humiphytes, and less robust plants, 3 of leaf mould to one each of loam and sand.

Wet Humiphytes, and Filmies, 3 of leafmould to one of sand.

Where thoroughly decayed dairy manure is obtainable 1 part may be substituted for an equal quantity of leafmould. To prepare a compost all should be passed through a half inch sieve. If the leafmould or loam are dry they will have to be watered with a fine rose as they are sifted, each sifted layer when an inch or so thick being given as much water as will remain on it, and the process repeated until these two soils are in one heap; allow the heap to stand for 12 or more hours when it can be broken down, the dry sand spread over it and the whole thoroughly mixed. For strong growers crushed bone may be added at 3 or 4 handfuls to the barrow of compost. Artificial manures generally, and lime in particular, are detrimental to ferns. During active growth when the soil is filled with roots, weak liquid manure once or twice a week will improve growth considerably.

Vegetative reproduction occurs in quite a number of ferns. In several species of Pteris and Aspleniums young plants are produced from the short stem or root stock. In other Aspleniums, the two Adiantums, *Dryopteris prolifera*, *Aspidium cicutarium*, *etc.*, buds are produced on various parts of the fronds, which may be taken off as soon as they have developed one or two fronds, and potted separately. Plants with long or short rhizomes may be divided, and the long rhizomes may be cut into pieces from which the strong growing ones make satisfactory plants very quickly.

The natural reproduction of ferns is mainly from spores, and where large numbers are required, the raising of ferns from spores is largely practised. Many species respond freely under satisfactory conditions. Others are very erratic, like the Bird's Nest Fern of Australia, which year after year may be a failure, and then develop in hundreds. Just what were the controlling factors are not ascertainable. It may have been that the spores are short-lived, — that the individual plants are sexually distinct, or too much or too little water present to suit the spermatozoids or fertilizing agent.

Spores for sowing should be obtained from healthy fronds, and the best way is to cut the fronds when some of the sori are opening or turning brown, fold in sheets of newspaper and hang up to dry for a week or so. Shake gently, so as not to break off any pinnæ, and the spores will be found as very fine dust at the bottom. Generally they should be sown at once as their vitality is somewhat variable so far as known. Pots or pans are the best in which to sow. Half fill with drainage, on which place a layer of moss, then the compost made up of finely reddish soil or sandy loam. Obtain a level surface an inch below the brim, by pressing firmly with the bottom of another pot. Water well and allow to drain. Good eyesight and care are required to sow the spores thinly, and owing to their lightness only one species should be handled at a time as they float in the air on the lightest breeze, often resulting in quite a different fern turning up in the pots than the one expected. Stand the pots or pans in saucers of water and place in a frame where a cool, moist atmosphere can be maintained. Sunshine must be excluded. The surface of the soil must never be allowed to get dry, and when the prothalli appear they should be given a light spraying with a syringe daily to supply the necessary medium of passage for the spermatozoids. It is customary to prick off little clumps of the prothalli, but generally they can be left until true fronds are developed, when the greatest care must be taken that the little crown rests only on the surface of the soil. and is not buried. A finely sifted light soil of equal parts of sand, loam and leaf-mould should be used at this stage, and the plants spaced about an inch apart in pots or tins. As soon as they have taken hold of the soil a gradual increase of light should be allowed up to the known requirements of the individual. When they are sufficiently strong they can be transferred to 3-inch pots, and receive the general treatment of their particular class.

It is doubtful if the above methods will suit the Xerophytes from the Karroo. It is reasonable to think that considerably drier conditions of the soil and in the air would be most likely to yield satisfactory results in any attempts to raise this class from spores.

The methods of cultivation indicated above are those most suitable for the Shade House, the Stoep, or the Greenhouse of the urban or suburban grower. The more ambitious can adopt the sunk-path and grotto style of accommodation if space permits in the open; a style that gives a surprising number of positions of varying degrees of light and moisture. To the fortunate owner of land with a small perennial stream, on the flat, or on the hillside, a comprehensive prospect opens up in the supply of suitable sites for

the various species, each with its own particular requirements catered for by some one or other particular spot.

The provision of bays at or near water level for the swamp plants will often yield material to form mounds for the bush-ferns. Pools can be formed at suitable spots and a fall of water secured by the judicious use of rocks on the upper side. At one or more points a side furrow may be laid to divert water to secure wet banks by percolation. Miniature krantzes require plenty of stratified rocks; or large granite boulders, split up, readily form crevices for the smaller growing epiphytes. Wet krantzes can be secured by a cement furrow perforated on the sides and at the spots the drip is required. A half-round furrow covered with galvanised iron permits of clearing stoppages readily. Irregular outlines and undulating surfaces carefully contrived will supply each its own particular conditions, which will suggest the particular plant it will best suit. Shade and shelter, if not existing, will have to be provided by trees and shrubs flanking the outer lines of the site, while here and there a yellowwood or wide spreading tree can throw its branches over the banks. An adequate path will have to be laid, here following the edge of the stream, there crossing over a causeway, then across a swamp by stepping stones, over a bridge, perhaps to an island, but always following a level from which particular points or plants can best be observed.

There is no doubt that an artificially made ravine with the many intricacies a fertile imagination can devise, is the most natural style of accommodation for native ferns. Given the space and the means to attain anywhere near completion it becomes an outstanding feature and pleasure to all beholders.

J. W. MATHEWS.

Kirstenbosch,
February, 1924.

Notes on the Family Rutaceæ.

THE family Rutaceæ is a large one, widely distributed in all the warmer parts of the earth, more especially in South Africa and Australia. Members of the Rutaceæ form important constituents of the flora which characterises the south-western part of Africa, a flora in which low shrubs with heath-like or small, leathery leaves predominate. Outside this area in South Africa members of the Rutaceæ are found but they are not an outstanding feature of the flora. The most widely known of such plants is the Cape Chestnut (*Calodendron capense*), a large and handsome tree which is frequently found in the forests of the Eastern Province. It is reported to extend northwards into the tropics and it is known to occur westwards as far as Swellendam, but its centre of distribution is in the east and in that respect the Cape Chestnut differs markedly from all its allies. The late Professor Pearson planned a Cape Chestnut Avenue as one of the attractions of Kirstenbosch, and the young trees may be seen lining the wide avenue which starts at the side of the ruins of the old homestead. Up to the present none of these trees has flowered, though some of the larger specimens ought to do so in the course of a year or two.

The family is best known to the world at large by the genus *Citrus*, which furnishes many well-known fruits, such as the orange and the lemon. In addition many of the Rutaceæ have a medicinal value, and it is in this connection that the South African members are best known, buchus needing no introduction to us.

The family, as is the case with most other large families, is sub-divided into several groups. One of these — the Diosmeæ — contains most of the genera to be found in South Africa, and therefore the following description concerns that group alone unless it is otherwise stated. The plants belonging to it are nearly all small shrubs with heath-like leaves, the most notable exception to this being the Cape Chestnut.

One of the outstanding features of the Rutaceae as a whole is the presence of numerous glands bearing a volatile oil and scattered all over the plant, especially on the leaves (Fig. C1). This oil possesses a strong smell and on hot, dry days the air round the plants is heavy with the scent given off by these glands.

Floral Structure

The floral structure in members of the Diosmeæ offers no special difficulties. In nearly all cases the flower is regular, the only exception being the Cape Chestnut, where the flower is slightly zygomorphic (i.e. with only one plane of symmetry) (Fig. B). The calyx consists of four or five sepals, somewhat joined at the base. The corolla has four or five free petals inserted just outside a disc. This disc which is nearly always present is an

important feature of the Rutaceæ, and varies in shape from a flat plate to quite a deep cup-shaped structure. These differences in the shape of the disc are to a large extent due to a growth in the floral axis just at the base of the calyx, leading to a condition known as perigyny in which petals and stamens are carried upwards and outwards on the enlarged floral axis and are thus situated some distance above the base of the ovary. *Empleurum*, which differs from the other Diosmeæ in having no petals and in having stamens and pistils in separate flowers, shows a simple type of flower in which the disc is wholly absent, and the stamens in the male flower arise just at the base of the rudimentary pistil. (Figs. A1, A2). An example of a simple plate-like disc is seen in *Barosma betulina* (buchu), where the amount of perigyny is very slight. (Fig. A3). *Agathosma apiculata* shows a cup-shaped disc with well-marked perigyny (Fig. A4). The stamens are four or five in number, alternating in position with the petals. In some cases five sterile stamens are present, opposite the petals and often looking much like them, e.g. the Cape Chestnut. (Fig. B). The ovary usually consists of three to five carpels, either joined to one another or partially free. In the latter case they are joined by a common style but as the fruit ripens this shrivels up and at maturity the carpels are free from one another. (Figs. D4, D5). Each carpel bears two ovules, but in most cases the development of one of these is arrested and in the fruit only one seed is found. The fruit is a capsule with a peculiar method of dehiscence to be described later.

The Genera

Eight of the ten genera described in the Flora Capensis are to be found at Kirstenbosch, some being native and others introduced. The key given below indicates the salient features separating these eight genera from one another, and will enable anyone to determine these genera in the field.

KEY TO THE GENERA OF THE RUTACEAE.

1. Carpels not separating in the fruit .. 1. *Calodendron*. [Fig. B.].
2. Carpels separating in the fruit. (One carpel only in Empleurum).
 *Petals present:
 a. Staminodes absent:
 i. Style much exserted and conspicuous at time of pollination 2. *Macrostylis* [Fig. H.].
 ii. Style not much exserted or conspicuous at time of pollination 3 *Diosma*. [Fig. D1.]
 b. Staminodes present:
 i. Staminodes concealed in channel running down the petals 4 *Coleonema* [Fig. G1.]
 ii. Staminodes obvious
 † Style rather short at time of pollination, stigma capitate 5. *Adenandra*. [Fig. F4.]
 †† Style about as long as petals at time of pollination, stigma simple.
 x. Inflorescence axillary, petals sub-sessile 6. *Barosma*.
 xx. Inflorescence terminal, petals with a stalk 7. *Agathosma*. [Fig. C2.] [Fig. E.]
 ** Petals absent 8.*Empleurum*. [Fig. J1, J2.]

Pollination

Those members of the family which have been studied in relation to pollination show interesting devices to prevent self-pollination. It will be sufficient to describe two plants, which though alike in general behaviour, show certain minor differences.

Adenandra uniflora is a pretty shrub with delicate pale-pink or white flowers. At an early stage, while still in the bud, and before the pollen has been shed, the stamens and staminodes appear as shown in Fig. F1. It will be noticed that the stamen has a very short filament and is capped with an olive green, stalked gland. The staminode has a red, glandular tip, which together with the staminal gland glistens in the sun as soon as the bud opens. At this stage the style is very short indeed and the stigma is a button-like object at its top. (Fig. F1). The pollen is shed soon after the opening of the flower and immediately before dehiscence the filament elongates considerably raising the anther above the neighbouring staminodes. The anthers ripen successively so that the pollen from any one flower is being shed for some little time. Just before dehiscence the style elongates slightly and bends over so that the top of the stigma, which is the receptive portion, is tucked away among the hairs on the ovary wall, out of the way of the flower's own pollen. (Fig. F2). Once the pollen has been shed the filament bends outwards and the shrivelled gland bends backwards (Fig. F3), out of the way of the style which proceeds to straighten itself and to elongate rapidly. The level of the ripe stigma is approximately that of the anther during dehiscence, so that it is very easy to imagine the way in which pollination occurs, though no observations as to the actual agent of pollination have been made.* Various species of *Barosma* show similar devices, clearly shown in Figs. C3, C4, C5, C6.

A second example in which changes of the same nature occur is *Diosma vulgaris*, one of the commonest members

* Dr. R. Marloth. — "Notes on the Functions of the staminal and staminodal glands in the Flowers of Adenandra." Ann. Bolus Herb. Vol. III part 1, May 1920.



M. M. Page.
Del. M. M. Page.

RUTACEAE.

of the Rutaceæ on the Cape Peninsula. Here the disc is conspicuous and deeply five-lobed (Fig. D1). The stamens, each situated in a sinus of the disc, have not the large glands characteristic of the previous plant. Staminodes are absent. The stamens elongate on ripening and bend outwards after dehiscence as before. The style exhibits the same three growth stages (Figs. D2, D3, D4), but here the stigma is tucked away, not amongst hairs on the ovary wall, but into one of the lobes of the disc. Thus by slightly different means self-pollination is discouraged.

Seed Dispersal

Seed Dispersal has only been studied fully in one plant — *Diosma vulgaris* — the plant we have just discussed with regard to its pollination mechanism. Doubtless most other plants of the Diosmeæ will show a similar series of changes if examined carefully.

The ovary consists of five carpels joined in the centre by their edges, but tending to separate from one another at maturity. (Fig. D5). If a single carpel be separated from its fellows shortly before the fruit is ripe and dissected, it will be found that its wall separates into two distinct layers, an outer green part, leathery and dotted with oil glands, and an inner horny layer with no oil glands and enclosing the seed. This layer shows a thin area on its inner face, the place where the seed was attached (Fig. D6). This inner layer is instrumental in bringing about the explosion which shoots the seed away from the parent plant. The single seed contained in each carpel has a shiny black coat and a much rounded base. (Fig. B8). As the carpel ripens the outer layer turns brown and becomes stiffer, though it retains to some extent its leathery character. Finally a vertical split occurs along its edge and this layer opens out exposing the inner layer to the air. (Fig. D6). This horny inner layer is intensely hygroscopic and as soon as it is exposed to the dry air changes occur rapidly. (As the fruit ripens about January the air is usually dry.) These changes can be induced by exposing the inner layer of a nearly ripe carpel to ordinary air for a short time. On losing moisture the two halves tend to twist and turn outwards, away from one another. When the strain becomes too great a vertical split begins, starting above and below the thin area on the inside of the carpel. (Fig. D7). This split extends rapidly over the top and down the back of the carpel, freeing the two halves in the upper portion, though these remain attached in their lower third. The two free portions turn outwards, at the same time twisting on an obliquely longitudinal axis. (Fig. D9). In doing so the lower portion becomes flattened and it is this process which forces the seed out in much the same way as one shoots a small round object like a marble from the tips of one's fingers by pressure. The seed, owing to its slippery coat, is admirably adapted for this purpose. Measurements taken before dehiscence show that the depth of the horny layer from back to front is about one and a half times as great as its frontal width. After the seed has been shot out the width is about four times the depth.

Thus we see that in this plant there is a definite contrivance enabling the seed to be shot some distance from the parent. The Diosmeæ all show a separation of the carpels into two distinct layers in the fruit, and it is therefore probable that this group will show similar adaptations for dispersal in its other members. Subsequent investigations will prove whether this assumption be correct or not.

M. R. Levyns.

Botanical Department,
University of Cape Town.
January, 1924.

EXPLANATION OF PLATE.

Fig. A. 1. Male flower of *Empleurum serrulatum*. Long. sect.
2. Female flower of *Empleurum serrulatum*. Long. sect.
3. *Barosma betulina*. Long. sect.
4. *Agathosma apiculata*. Long. sect.

Fig. B. Half of flower of *Calodendron capense*.

Fig. C. *Barosma betulina*.
1. Leaf. 2 Half of flower. 3, 4 and 5 Stages in development of pistil. 6. Flower showing various stages in the development of the stamens.

Fig. D. *Diosma vulgaris*. 1. Half of flower. 2, 3, stages in development of the pistil. 4, 5, Development of fruit. 6. Carpel opened out to show the two layers. 7. Inner layer at the beginning of dehiscence. 9. Inner layer just after dehiscence. 8, Seed.

Fig. E. *Agathosma imbricata*. Half of flower.

Fig. F. *Adenandra uniflora*. 1. Pistil, portion of the disc, a stamen and a staminode from a young flower before pollen has been shed. 2. Pistil at the time pollen is being shed. 3. Same parts as shown in Fig. 1, but with stigma ready to be pollinated. 4. Half of young flower.

Fig. G. *Coleonema album*. 1. Half of flower. 2. Single petal showing staminode in channel.

Fig. H. *Macrostylis villosa*. Half of flower with ripe stamens.

Fig. J. *Empleurum serrulatum*. 1. Male flower. 2. Female flower.

Cultivation of South African Rutaceæ.

THE order as represented in South Africa consists of upwards of 200 species. One, the Cape Chestnut, is a good-sized tree, the remainder being evergreen shrubs, attaining 15 feet or so in Empleurum, but mostly of a dwarf and free flowering habit. The flowers are white or mauve, or white more or less tinged with rosy mauve. The flowers are mainly axillary and in the mass give a soft misty effect in general. The foliage is highly scented, some sweet, some aromatic, some vile and pungent and lasting, a close acquaintance with which is not readily forgotten. The sweet and aromatic species are most numerous, and as a collection would of themselves make a very interesting Herb Garden. They would also make useful subjects in the Wild Garden, Pleasure Grounds, or Park, either massed or in irregular groups of species. Being neat, bushy, and evergreen they are presentable when not in flower, and the severest drought does not seem to affect them on well trenched ground. As dwarf hedges, or as an edging, many would seem most useful. The foliage of several much resembles the European Myrtle, and in others that of the Thyme, but more upright and bushy. If suitably selected for the height they are to grow, little trimming would be necessary to keep them in bounds. By allowing space for each to assume its natural width and outline from side to side, effective and distinctive lines could be secured.

A well-drained open loam in a sunny position will suit them. The summer following planting out, one or two heavy waterings may be necessary, but when once established the rainfall will generally be sufficient.

To secure a stock, plants may be obtained from the wild, or seeds collected from them. Germination may be erratic, but if sown during February or March in a light sandy loam in tins, the seedlings resulting can be planted out about May on their permanent sites. Lifting and transplanting should be carefully done to retain the roots intact. The best stage for transplanting is at the start of the first shoot between the seed leaves or cotyledons. This method has been successful with Buchu seedlings during the past season, those kept moist by watering giving very satisfactory results.

Some observations were given on Buchu in the Society's Journal for 1918, and a pamphlet giving further details is obtainable from the Gardens. The cultivation given therein is in the main suitable for the more decorative species. But the raising of seedlings in tins, and transplanting is preferable to sowing *in situ* as for commercial purposes.

Propagation by cuttings in the open is not satisfactory, but where frames and bell-glasses are available, satisfactory results should be secured.

The large body of Rutaceae are found on the hill sides, in rocky and stony slopes, or in open scrub. A few species favour wet places, about three inhabit limestone foundations, and a good percentage are found on sandy flats and dunes. As these become better known, no doubt some will turn out useful in particular localities.

J. W. MATHEWS.

Kirstenbosch,
February 1924.

The Kew of South Africa.

IN July last the Prime Minister opened the new Herbarium which has been built at Pretoria in connection with the Department of Agriculture. In his speech General Smuts gave evidence of the interest that he takes in botanical work, quite apart from its economic bearings. While calling attention to the practical needs that a herbarium could satisfy, he said that the purely scientific aspect of botanical work was the most important: and he went on to discuss some of the problems of plant migration which are involved in the study of the South African flora. In conclusion he said "You want a Kew. What Kew is to England and the British Empire this national herbarium must be to South Africa."

This pronouncement was received with great astonishment by many botanists and others, and has been the subject of comment in the press and in scientific journals. To show the line that has been taken, I give a quotation from the Kew Bulletin, (1923, p. 406): this being the official publication of Kew itself, and therefore specially worth studying in this connection.

"In referring to South Africa's need of a Kew, General Smuts, as reported, made no allusion to the "botanic garden" side of Kew which is already in existence in the National Botanic Garden at Kirstenbosch. It is quite true, as he so ably points out, that a comprehensive herbarium is essential to our knowledge of the flora of a country, but the garden side where the living plant can be studied is of equal importance. It is therefore much to be hoped that while doing all it can to further the work of the Botanical Survey and help forward the Herbarium, which has been opened under such auspicious circumstances, the Government of South Africa will not in any way neglect to give adequate assistance to the National Botanic Garden, Kirstenbosch. This garden, which was started largely through the initiative of the late Professor Pearson, has great possibilities, and from the Reports that have reached us it does not appear to have received its due meed of recognition and support from Government. We venture to express the hope that a Government which is so enlightened in matters botanical and agricultural as is that of the Union of South Africa, now that it has established so essential an institution as a National Herbarium, will not neglect its National Botanic Garden, which was founded so wisely a few years ago.

"South Africa is singularly fortunate in possessing not only a remarkable flora, which must be most zealously guarded and studied, but also a Prime Minister who knows it so well and appreciates to the full its value and interest. To achieve the attainment of the ends that General Smuts has outlined a Botanical Garden as well tended and provided for as may be possible is essential. In the past the foundation of the Garden has usually preceded the establishment of the Herbarium, but in South Africa the Herbarium appears to have received the greater attention. The new National Herbarium alone cannot be to South Africa what Kew strives to be to Great Britain and the Empire any more than can the Kirstenbosch Garden represent every side of Kew's activities.

"If however, the new National Herbarium and the complementary National Botanic Garden at Kirstenbosch can be coupled together in the matter of adequate financial support so that their united work may be National, not merely in name but in fact, then the Union of South Africa will indeed possess a worthy counterpart of "Kew" fitted to answer the botanical and agricultural problems that confront the Country."

It is possible that the Kew writer was not altogether aware that the relations of the new herbarium and Kirstenbosch respectively to the Government are different: the former is an official institution, a branch of the Division of Botany, while Kirstenbosch is a grant-in-aid institution controlled by a board of trustees of whom a majority is appointed by Government. This however does not affect the main argument, which is that Kirstenbosch is an essential part of the botanical activities of South Africa, and that it is being quite inadequately supported by the Government.

* * *

Let us now see what comments "Nature", the most widely circulated and authoritative general scientific journal in the British Empire, makes on the subject (Jan. 26. 1924. p. 134).

> "General Smuts apparently made no allusion in his speech to the National Botanic Garden at Kirstenbosch. Whilst a good herbarium is an essential part of the activity at Kew, an equally essential part is the museum of living plants provided by the Botanic Gardens and their glass-houses, and it is to be hoped that General Smuts will, at the proper time, show as active an interest in the further development of the Gardens at Kirstenbosch, near Cape Town, where the site is provided for a really magnificent garden, but where development is at present greatly hindered by the lack of adequate financial support, support which in part must always be received from the Government."

* * *

It is clear that both the "Kew Bulletin" and "Nature" are surprised that Kirstenbosch, which was founded as the National Botanic Garden of South Africa long before the establishment of the Botanical Survey and its associated herbarium, should have been neglected if what the country really wants is a "Kew". In Kirstenbosch and the Bolus Herbarium an embryo South African Kew already exists. These two institutions were associated from the first: the Bolus collection was (and still is) the finest in South Africa; and Kirstenbosch is potentially one of the world's great botanic gardens. The Bolus Herbarium ekes out an existence on the bequest of its founder: Kirstenbosch is starved of funds. And yet it is seriously proposed to establish and finance another "Kew" in Pretoria! Is it official blindness or jealousy, or is it an example of the mania for centralisation?

The *Cape Times*, on 25th July, 1923, published a leader on the subject, which puts the situation so clearly and broadly that I will quote it in full:

BOTANY IN SOUTH AFRICA.

"Few scientific subjects make a more general appeal to mankind than the study of plants. Flowers charm all but the most hardened of us; and the botanist, for all his formidable vocabulary, is more akin to the plain man with his liking or enthusiasm for flowers, than many a scientist of other branches of learning. The trite remark that one knows nothing about flowers but is very fond of them finds an echo in the heart of every true botanist, for the more he probes and dissects the deeper becomes his reverence for the beauty and mystery of plant life and the keener his sense of his own ignorance. The study of plants can be shared by all, from the Woodstock children whose chief delight is their periodical open-air nature study class at Kirstenbosch to the Prime Minister himself. Those who were perhaps surprised to find General Smuts discoursing on botanical subjects cannot have heard of his keen interest in South African grasses; or of his own vigorous botanisings with the General Manager of Railways on their Rhodesian tour; or of his diligent study of the grass specimens in, or rather crowded out of, the Bolus Herbarium of the University of Cape Town. In the address which General Smuts gave at the opening of the new herbarium building at Pretoria he touched picturesquely on the conflict between the floras of the North and South, and imagination is fired by the picture of the old aristocracy of the South, with all its beauties and graces, waging an unequal age-long struggle with the hordes of barbarian invaders from the North. One might stretch the metaphor further and see Southern nobility led captive to die in exile, in the form of the heaths and proteas of the Cape which wither in the vases of Johannesburg and Bloemfontein. Or one might see in this vegetable warfare an emblem of the way in which the natural development of the South is so often deliberately hindered by opposition from the North.

And this last application of the Prime Minister's parable finds a new exemplification in the very subject of his discourse. The new Pretoria herbarium is to be the South African Kew, says General Smuts. But surely Kew is a botanic garden and not merely a herbarium; or rather, it is a botanic garden of which the herbarium forms an essential part. And when General Smuts says that South Africa wants a Kew, he overlooks the fact that we have already a Kew in the making. It is not at Pretoria; it never can be there. It is situated among the floral aristocracy of the South, at Kirstenbosch. In the National Botanic Gardens we have the future Kew of South Africa. When the Bolus Herbarium, admittedly the greatest and best arranged herbarium in the country, is established at Kirstenbosch, the natural centre for the scientific study of the South African flora will be there. The Bolus Herbarium represents the work of one man, unsubsidised. Kirstenbosch relies largely on voluntary contributions, given through the Botanical Society. The Government withholds the most urgently necessary grants from Kirstenbosch, South Africa's natural Kew, while spending lavishly on the pseudo-Kew of Pretoria. It is notorious that Kirstenbosch has been and is being starved. Its service and residential buildings are disgracefully inadequate, and it has no scientific equipment whatever. It receives an annual grant of a mere £1,500 from Government, as against the £6,000 (plus £3,000 gate charges) received by the National Zoological Gardens, Pretoria. A specially appointed Commission of experts recently went thoroughly into the question and reported unanimously in favour of substantially increased grants for necessary work and development at Kirstenbosch. The advice of the experts was rejected by the Government on grounds of economy which we admit in present circumstances to be imperative. But that being so, why build at Pretoria a herbarium at a time when economy is insistent?

While granting the potential value to South African agriculture of this new "national" herbarium, we cannot help remarking that Kirstenbosch is not being treated fairly. We suggest to the Government that it is time they regarded the matter purely from the standpoint of making the best use of the botanical resources and talent of the country. The tendency of the Department of Agriculture is far too much to encroach upon the strictly scientific aspects of their technical subjects —aspects which belong more properly to the Universities and to such institutions as Kirstenbosch. It is admittedly difficult to draw a sharp line between pure and applied science. Over and over again economic discoveries of the first importance have resulted from researches with a purely scientific aim; but examples of results of scientific value accruing to investigations with an economic goal are comparatively rare. Official Departments in particular should on general principles leave pure scientific work alone, though the Government should finance such work at purely scientific institutions up to the limit of its capacity. Has the Division of Botany, for instance, a mandate to deal with non-agricultural aspects of the science? The various Divisions of the Department have their economic and advisory sphere; purely scientific work is not their

métier, a fact sometimes too obvious. The sooner this is recognised the sooner will peace, equilibrium and economy supervene in the troubled relations between the Department and other scientific institutions of the country, and in the struggle between North and South".

* * *

The main arguments can be summarised as follows:

South Africa already has the beginnings of its "Kew" in Kirstenbosch working in association with the Bolus Herbarium. The sound policy is to develop these institutions rather than to spend new money on fostering a rival herbarium in Pretoria which cannot take their place.

The Division of Botany, which is one of the branches of the Department of Agriculture, should confine itself to Agricultural Botany, and should not attempt to cover the whole science: pure botanical science should be entrusted to non-government institutions, namely botanic gardens, museums, herbaria, and University botanical departments. This is the economical method and is productive of the best results in practice: pure science does not flourish in Government offices.

The situation is a serious one for Kirstenbosch and for South African Botany in general; and this article with its quotations from authoritative periodicals has been written to call the attention of Members of the Botanical Society to the danger that threatens the institution and the science that they have done so much to foster during the past ten years.

R. H. COMPTON.

Kirstenbosch,
March 1924.

The Botanical Society of South Africa.

ANNUAL REPORT, 1923.

The Council has pleasure in submitting the eleventh Annual Report of the Society.

MEMBERSHIP.—The membership of the Society stands at: Life Members, 59; Family Members, 50; Members, 405; Associates, 269; total 783, as compared with 826 in 1922.

ANNUAL GATHERING.—The Annual Gathering at Kirstenbosch was held on Saturday, Nov. 10th, and was well attended by members and their friends.

COUNCIL MEETINGS.—Three meetings of the Council have been held during the year.

ANNUAL GENERAL MEETING.—At the Annual General Meeting, held on March 28th, the following officers were elected for the year:—

President: The Right Hon. Sir James Rose-Innes, P.C., K.C.M.G.

Vice-Presidents: Sir Lionel Phillips, Bart., the Hon. Sir Lewis Michell, C.V.O., and Mr. Max Michaelis.

Members of the Executive Council: Professor R. S. Adamson; Mr. W. Duncan Baxter; Mrs. F. Bolus; Mrs. Carter, C.B.E.; Mr. F. E. Cartwright; Professor R. H. Compton; Mr. W. A. Eaton; Miss Fairbridge; Mr. W. Greenacre, M.L.A.; Mr. P. Stuart Horne; Lady Rose-Innes, C.B.E.; Mr. H. T. Twentyman-Jones; Mr. W. de N. Lucas; Mr. H. C. Starke; Miss E. Struben; Mr. A. Walsh; Mr. W. Webber, M.L.A.; Miss F. M. White; Mrs. H. S. van Zijl; Major G. B. van Zyl, M.L.A.

At the first meeting of the Council Mr. W. A. Eaton was elected Chairman for the year; Mr. H. T. Twentyman-Jones, Hon. Treasurer; and Mrs. F. Bolus, Hon. Secretary.

JOURNAL.—The Journal of the Society was published in March, and was edited by Professor Compton, to whom the Council tenders its appreciation and thanks.

BOTANY RAMBLES.—The Botany and Nature Study Walks instituted by the Society were taken over by the Education Department, and have been conducted throughout the school year by Miss Starke. There were over three thousand attendances. In connection with this work, and in order to give a wider publicity to the National Botanic Gardens, the Hon. Secretary, Mrs. Bolus, has written monthly articles during the year, dealing with the nature-study of Kirstenbosch. These have been published by the Specialty Press in "South African Gardening" and in "Nature Notes," with many illustrations derived from Mr. E. J. Steer's excellent photographs. The Council's acknowledgments are due to Mr. Steer and the Specialty Press for the great interest they have taken in the work of getting Kirstenbosch better known throughout South Africa.

VACATION COURSES.—One vacation-course in Botany and Nature Study was conducted by Mrs. Bolus in January of three weeks' duration. This was attended by 9 students.

INFORMAL GATHERINGS.—An informal gathering was held in April 7th, when Mr. Mathews gave an interesting demonstration on pruning. After the demonstration the party was conducted round the Gardens. Seeds and cuttings were distributed.

TEA HOUSE.—For several years members have been urging the necessity of a tea house in the Gardens. The Council considered the question and decided to grant £400 from the Life Members' Fund on condition that the same amount be collected from the public on the £ for £ principle. Through the tact and energy of Mr. Frank Cartwright, the sum of £377 10s. 6d. has been collected up to Dec. 31st, 1923. This sum, together with a like amount from the Society's Life Members' Fund, is available for building the tea house. It is hoped that the final arrangements for its erection may soon be completed and that the finished building will be ready for the public before very long.

FINANCIAL.—The audited Financial Statement accompanies this Report, and from this it will be seen that the sum of £492 6s. 9d. has been available for the purpose of augmenting the funds of the National Botanic Gardens as compared with the sum of £460 10s. 7d. in 1922.

During the last financial year, as per annexed list, the sum of £155 5s. has been collected. In this connection we have specially to thank the Divisional Council of the Cape and W. Duncan Baxter, Esq., for their generous donations.

APPEAL FOR NEW MEMBERS.—Members are reminded once more that the chief object of the Society is to obtain subscriptions in order to augment the income of the National Botanic Gardens, and they are earnestly requested to induce their friends to join the Society. As development in the Gardens progresses more funds are needed for the maintenance of these improvements. On the other hand the Gardens are now in a position to give their supporters seeds and cuttings of many interesting plants which members would be unable to obtain elsewhere.

N.B.—(1) Life Members, £25. (2) Annual Members: Family Members, £2 2s.; Ordinary Members, £1 1s.; Associates, 5s.

The Council has to express its indebtedness and hearty thanks to Mr. R. L. McDonald for auditing the accounts; to the City Council and the South African Association for the use of rooms for meetings; and to the Press for valuable assistance in reporting matters of interest.

(Signed) W. A. EATON, *Chairman.*
L. BOLUS, *Hon. Secretary*

BALANCE SHEET AS AT 31ST DECEMBER, 1923.

LIABILITIES.	£ s. d.	£ s. d.
Life Members' Reserve Fund ..	680 0 0	
Added during year	125 0 0	
	805 0 0	
Less amount donated to Kirstenbosch Tea House	377 10 6	
		427 9 6
Subscriptions paid in advance ..		31 5 0
Sundry Creditors		1 8
Kirstenbosch Tea House Fund.		
Donations as per Schedule attached	377 10 6	
Donation by this Society on £ for £ basis	377 10 6	
	755 1 0	
Less amount paid over to Trustees, National Botanic Gardens	500 0 0	
		255 1 0
Amount paid over to Trustees National Botanic Gardens per contra		155 5 0
National Botanic Gardens:		
Surplus for year ..	492 6 9	
Less paid over	439 9 5	
		52 17 4
		£921 19 6

ASSETS.		£ s. d.
Fixed Deposit:		
Cape of Good Hope Savings Bank	311 12 4	
Accrued Interest	8 2 0	
		319 14 4
Investment Account:		
Union of S.A. 5% Loan 1929/39 at cost	200 0 0	
Accrued Interest	2 17 10	
		202 17 10
Amount collected for National Botanic Gardens, as per Schedule attached, per contra		155 5 0
Cash at Bank		244 2 4
		£921 19 6

REVENUE AND EXPENDITURE ACCOUNT FOR 12 MONTHS ENDED 31ST DECEMBER, 1923.

To Bank Charges			14 7		
Gathering of Members at Kirstenbosch			10 6 8		
General Expenses			26 6 0		
Stationery, Printing and Advertising			6 11 6		
Journal Account			74 12 0		
Balance — Surplus			492 6 9		
			£610 17 6		
By Subscriptions:—					
Ordinary		409 6 6			
Family		109 17 0			
Associate		58 16 0			
				577 19 6	
Interest				29 5 8	
Sale of Panorama Views				3 12 4	
				£610 17 6	

Schedule showing how the amount of £755 1s. 0d., collected by this Society on behalf of the Fund for the Tea House at Kirstenbosch is made up.

Sir Lionel Phillips	50 0 0		
R. L. McDonald, Esq.	10 0		
Miss N. de Jager	1 1 0		
Mrs. F. Bolus	5 0 0		
Mrs. H. Burton	5 5 0		
H. O'K. Webber, Esq.	1 0 0		
R. L. Kramer, Esq.	1 1 0		
W. de N. Lucas, Esq.	1 1 0		
Sir Lewis Michell	10 0 0		
W. J. Thorne, Esq.	5 0 0		
W. A. Webster, Esq.	150 0 0		
Baroness Rothschild	15 0 0		
Miss M. White	1 0 0		
Miss F. White	1 0 0		
Miss Arbuthnot	5 0		
Miss Taylor	5 0		
Specialty Press	1 13 7		
Sir D. P. de Villiers Graaff	10 10 0		
Senator F. F. Churchill	2 2 0		
M. Michaelis, Esq.	100 0 0		
W. A. Eaton, Esq.	5 0 0		
T. A. Dockrall, Esq.	2 2 0		
Miss F. E. Trill	2 2 0		
Sundry Persons	2 13 11		
	377 10 6		
Donation by this Society on £ for £ for £ basis	377 10 6		
		£755 1 0	

Schedule showing how the amount of £155 5s. 0d., collected by this Society on behalf of the National Botanic Gardens is made up.

Divisional Council of the Cape	£100 0 0	
W. Arkwright, Esq.	4 4 0	
Mrs. Sharp	1 1 0	
W. Duncan Baxter, Esq.	50 0 0	
		£155 5 0

Audited and found correct.

(*Signed*) W. A. Eaton, *Chairman*,
(*Signed*) H. T. Twentyman Jones, *Hon. Treasurer*.

Cape Town.
23rd January, 1924.

R. L. McDonald.
Hon. Auditor.

Speeches delivered to the Botanical Society during 1923.

THE Annual General Meeting of the Botanical Society was held in the City Hall, Cape Town, on 28th March 1923, Sir Lewis Michell, one of the Vice-Presidents, being in the Chair.

The following speeches, as reported in the *Cape Times*, were delivered:

THE CHAIRMAN, in moving the adoption of the report, said that they had had again to contend against many adverse circumstances, but he thought they might congratulate themselves on their good fortune in having, as the Director of the Gardens, such a man as Professor Compton, who had so efficiently filled the vacancy caused by the still-lamented death of Professor Pearson.

"Our trouble now," continued the Chairman, "is mainly one of finance. We have been frankly disappointed in our hope of increased Government support, but allowance must be made for the Minister of Finance, who had carried on in difficult times, not only war, but post-war times, and has acutely felt what has been well called 'the eternal want of pence that vexes public men.' I feel sure that we have Mr. Burton's sympathy, and can rely on his future assistance as soon as circumstances permit.

"In the meantime it is obviously our only policy to endeavour to increase our membership by every means in our power. The value of our Society to the whole of South Africa is freely admitted, and will become more and more marked as time passes. It is one of our functions to convince all the Provinces of the Union of the desirability of preserving the indigenous flora with which our country is so richly blessed.

"I have alluded to our strenuous struggles in the matter of finance, but we have, I think, an even sterner contest to wage against the ignorance and apathy of the public. Our institution must not be regarded as the fad of a few enthusiasts, but as a much-needed branch of public education. Now, education, as Sir Frederic de Waal will tell you, is an expensive process, but, whatever it costs, it will, if wisely directed, be worth the money. Thus far, with much stress and strain, we have made good our position, and thanks for it are due to the very capable staff we are fortunate enough to possess. We must not be faint-hearted or relax our efforts and later on, when we have all passed away, South Africa may, perchance, say of us: 'They builded better than they knew.'

"In conclusion, I would remind you of two concrete, rather pressing, needs at the Gardens. The first is that of a regular motor 'bus service to Kirstenbosch, so as to bring the place into easier access, so far as the public are concerned; and the second is the erection of a tea house, which would help to popularise the place. Donations in aid of these objects will be thankfully received by the Hon. Treasurer. I may also mention that the Education Department has appointed a teacher to conduct study classes at the Gardens, fuller information as to which can be obtained from the Hon. Secretary. We hope that every member of the Society will turn missionary, and thus spread a wider knowledge of the aims and activities of those who are endeavouring to make the Gardens the success which they deserve to be."

MRS. BURTON expressed pleasure at hearing that there were to be a tea-house and motor-'busses, and said that the idea of Kirstenbosch was not to keep it for the elect. At present it was very difficult of access, but if they first of all got the motor-'busses and then had a nice little tea-house, she thought there would be such keenness and enthusiasm that they would increase their membership substantially. They would be surprised to know the cutting remarks that were now made. They only wanted £400 for a tea-house, and it was up to all of them to work for that object. She felt that once the tea-house was a fait accompli they would be able to use it very largely as a social centre, and people would take their friends there for afternoon tea. The great thing was to get people really interested, and the more accessible the Gardens became the more interest was found to grow. She had on some occasions taken people from up-country along with her to the Gardens, and she had noticed that on every occasion that they had been there they had become distinctly keener.

SENATOR CHURCHILL remarked that the fact that Kirstenbosch was three miles from the nearest stopping place debarred a good many people from visiting it. There was always something new to see in the gardens, and if only people realised that they would make a far larger number of trips than they did.

MR. CARTWRIGHT mentioned that the Society had approached the Tramway Company and asked them if they could run 'busses from the mail steamers to the Gardens, but the company said that previous efforts in this direction had not been very successful, and they were rather reluctant to undertake it again. It seemed to him that the best thing to do to make Kirstenbosch attractive from a visitors' point of view was to provide a really decent tea-house. When that was done he thought they would have no difficulty in getting the Tramway Company to re-instate the 'busses It seemed to him that their premier object was to erect a tea-house, and for that they had to provide £400. Mr. Michaelis had promised £100 and Sir Lionel Phillips £50, leaving £250 still to be obtained. Plans had been prepared for a building in keeping with the surroundings, and providing the necessary accommodation, and he hoped that those who were willing to contribute towards the expense would come forward without his going to them.

PROFESSOR COMPTON said that the question of the site had not been decided, but it would probably be somewhere near the old ruin, and convenient of access for motor-cars and motor-'busses There was one factor that came into the discussion, and that was the new road, which was to be completed within the next three months. When it was completed Kirstenbosch would be on the round-the-mountain road, and a tea-house would be absolutely necessary. There would be crowds of people going to the Gardens, and they would be disappointed unless they could get reasonable refreshments.

* * *

At the Annual Gathering of the Society held at Kirstenbosch on 10th November, 1923, the following speeches were made after tea, under the oak tree on the Lawn:

SIR JAMES ROSE-INNES pointed out that one of the great needs of the Gardens was for a proper hostel for students and gardeners who had to live close to their work. The late Professor Pearson, the founder of the Gardens, whose grave was on the slope above the Fern Dell and whose inspiration was still with them, had seen the need for the hostel and a sum of about £1,400 had been collected to build a hostel which should be a memorial to him. Hostel accommodation had for six years been provided by a ladies' committee who had guaranteed it financially, and thanks to the splendid efforts of Mrs. Bolus and Miss de Jager, the hostel was now being carried on without loss. (Applause.) Mrs. Bolus, who was the moving spirit of the Society. had also instituted nature study lessons for children at Kirstenbosch, and this work had now been placed in the hands of Miss Starke, who took regular classes in nature study which were a great success. Since the beginning of the year there had been no less than 2,750 attendances. As an instance of their value and popularity Sir James said that early one morning three small children had been found sitting in the Gardens, and on being asked they said that they were waiting for the nature study teacher. Not having enough money for a tram-fare, they had walked from Woodstock to Kirstenbosch to attend the class. Sir James also spoke of the scheme for a Tea House in the Gardens. The Botanical Society had voted £400 from the Life Members' Fund, and about £450 had been collected, chiefly by Mr. Frank Cartwright, and now they were about to build. Mr. Cartwright had told him that he had not met with a single refusal, though no doubt he had been careful whom he asked. (Laughter.) A sum of about £300 was still required for equipment, and if anybody present felt he had the money to spare for the purpose let him come forward. Mr. Mathews had signified his willingness to give monthly demonstrations of gardening at which seeds would be distributed, and this would be a great attraction to members. Sir James also mentioned that the Railway Horticultural Society was holding a show and sale of plants in aid of Kirstenbosch next Wednesday, and that anyone who had plants to give for this purpose should communicate with Mr. Peers (Box 912, Cape Town).

The Society needed more members: it had about 900 and it wanted to make it up to 1,000 and then to go beyond the thousand. The Government had not contributed to the Gardens so liberally as it should have done, and friends of Kirstenbosch had to put their hands in their own pockets to support the good work that was being carried on and to make it one of the world's great gardens. Kirstenbosch was primarily a scientific garden, and one should not expect to see startling masses of colour; but at the same time it aimed at interesting and giving pleasure to the general

public, and so they were trying to provide decorative beds and a display of spring flowers. More gardeners were required, and this meant that increased support and an increase in membership of the Society were necessary. (Applause.)

PROFESSOR COMPTON welcomed members of the Society and their friends and the many distinguished guests to Kirstenbosch. This occasion was an "At Home," but the Botanical Society ought always to feel that it was really at home at Kirstenbosch. The Society had done an enormous amount in the past both by way of subscription and by the personal interest and encouragement it had given. Every new member meant a fresh stimulus to the staff to work for the advancement of the Gardens. It was a tremendous advantage to have this personal support in addition to the more impersonal aid of public bodies.

The Gardens and the Society had now been in existence for ten years, and despite the troublous times they had been through there was a solid record of achievement. Kirstenbosch had made a good start: its foundations were well and truly laid, and he ventured to think that it was already one of the world's great gardens; it was the only one which devoted itself chiefly to the flora of the land in which it was situated.

During the past year three things had happened which would make a big difference to the Gardens The road to Constantia Nek had been completed, and this would mean a great increase in the number of people who would pass the Gardens and, he hoped, would come inside. This was where the Tea House would be specially useful. Then the Trustees had taken over the control of all the slopes behind the Gardens as high as the sky line and beyond, and this area of 1,100 acres would be maintained as the Upper Kirstenbosch Nature Reserve for the protection of the wild flora and fauna; the acquisition of this area would be a magnificent thing for the Peninsula. (Applause.) The third event was that the herbarium bequeathed to the University of Cape Town by Dr. Bolus was to be a neighbour of Kirstenbosch, and that a tender for the building had been accepted a few days ago. The harmonious working together of the two institutions would be of incalculable benefit to both, and should go far to making Kirstenbosch the greatest centre of systematic botanical science in the Union.

In all parts of the Gardens development could be seen. There had been a fine display during the winter and spring, and the Gardens generally were in a cleaner, healthier, and more promising condition than ever before This was due to the splendid work of the Curator, Mr. Mathews, and to the staff under his control, Mr. Cook and Mr. Fox being specially mentioned. In addition, Professor Compton congratulated Miss de Jager on the way in which she had carried on the work of the hostel under conditions that would daunt anyone less brave; and Miss Starke on the way she was introducing nature study, the best of all studies, to teachers and to children. In conclusion he expressed thanks to the Ladies' Committee and to those who by their help and gifts had made the gathering such a successful one.

The visitors then inspected the work and recent developments in the Gardens, and dispersed after one of the most delightful gatherings in the history of the Society.

Programme of Society's Activities during 1924.

NOTICE TO MEMBERS.

The Council of the Botanical Society has authorised the Hon. Secretary to announce that a meeting of Members and Associates and their friends will be held at Kirstenbosch on *the third Saturday of each month* throughout the year. These meetings will include three informal gatherings, when the Director will take the party round the Gardens and point out matters of interest; eight gardening demonstrations by the Curator; and the Society's annual "At Home". Seeds and cuttings will be distributed as available. It is proposed to ask women members to provide a simple tea and to act in turn as hostesses.

The following dates have been fixed:—

January 22nd: Informal Gathering.

February 16th: Gardening Demonstration. Composts and sowing fleshy seeds of Amaryllidaceæ.

March 15th: Gardening Demonstration. Resumé. General seed-sowing.

April 19th: Informal Gathering.

May 17th: Gardening Demonstration. Pricking-off and potting.

June 21st: Gardening Demonstration. Pruning.

July 19th: Informal Gathering.

August 16th: Gardening Demonstration. Insecticides and Spraying.

September 20th: Gardening Demonstration.

October 18th: Annual " At Home ".

November 15th: Gardening Demonstration. Manures and watering.

December 20th: Gardening Demonstration. Answering general questions and|or water-gardening.

Members are requested to bring their friends in order to introduce them to the Gardens and to interest them in the work being carried out there. The meetings will begin at three o'clock, unless otherwise announced.

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Hon. Secretary.

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MEMBERS of the Society are invited to assist in stocking the Gardens with native plants. Specimens from all parts of Africa are desired. At present representatives of the following are particularly needed: *Aloes*, *Bulbs*, *Ferns*, *Proteas* (seeds), *Heaths* (branches bearing old flowers), *Succulents*, *Woody Leguminosae*, medicinal, aromatic and other economic plants.

From places within the Union (including S.-W. African Protectorate) consignments can be sent free by rail (S.A.R. and N.C.C.R.) or post if addressed:

BOTANICAL SPECIMENS, O.H.M.S.

To

THE DIRECTOR,

National Botanic Gardens,

Kirstenbosch,

Newlands, Cape.

From Northern and Southern Rhodesia seeds and plants may be sent by post at Sample Rate, without preliminary inspection or fumigation. From Southern Rhodesia plants travel by rail at half-rates as far as Mafeking, and thence free to Kirstenbosch.

INSTRUCTIONS FOR PACKING AND SENDING SPECIMENS.

Cotyledons, *Crassulas*, *Euphorbias*, *Aloes*, *Stapelias*, *Mesembrianthemums* and other plants of a like succulent nature, and also the *Epiphytic Orchids*, should be packed dry. Each species should be wrapped in paper and laid tightly in a box. Large specimens of *Aloes*, *Euphorbias*, *Cycads*, etc., may be trucked loose.

Large specimens of Tree Ferns should be bound in wet grass or canvas, or with a little damp moss inside the canvas and the stems should be strengthened with poles.

Ferns, Bulbous and Tuberous Plants in growth and flower need a little damp moss among the roots.

Distinct species of dormant bulbs and tubers, as well as of seeds, should be sent in separate wrappers.

Each consignment should bear (1) the name and address of the sender; (2) the locality in which the specimens have been gathered. Brief notes as to habitat (wet, dry, sun, shade, sand, clay, and so on), are most valuable.

Contributors of economic plants are requested to send particulars as to their properties and the methods of using them.

Common as well as rare species will be welcome. Fully addressed labels can be had on application to the Director.

THE BOTANICAL SOCIETY OF SOUTH AFRICA.

OBJECTS.

(*a*) To encourage the inhabitants of South Africa to take an active part in the progress and development of the National Botanic Gardens at Kirstenbosch, a part of the Groote Schuur Estate, in the Cape Province, and to induce them to appreciate their responsibilities therein.

(*b*) To augment the Government grants towards developing, improving, and maintaining fully equipped botanical gardens, laboratories, experimental gardens, etc., at Kirstenbosch.

(*c*) To organise shows at which may be displayed the results of botanical experiments or cultural skill in improving the different varieties of South African flora.

(*d*) To enlighten and instruct the members on botanical subjects by means of rambles, meetings, lectures, and conferences, and by the distribution of literature.

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Those wishing to become Members of the Society are invited to communicate with Mrs. F. BOLUS, Hon. Secretary, P.O. Box 45, Cape Town.

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